

INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

FIRST PART.  
ORIGINAL ARTICLES

**Mechanical Ploughing.**

**Methods of Ploughing without Ridges**

by

A. TARCHETTI.

*Director of the Mechanical Department  
of the "R. Stazione Sperimentale di Riscoltura" at Vercelli, Italy.*

The most important factors controlling the yield from a machine plough are the way the land is set out and the choice of the most suitable method of ploughing.

As is well known there are two systems of ploughing — ploughing with or without ridges (1).

PLOUGHING WITHOUT RIDGES.

In this method the furrow-slices are turned always to one side and no open furrows are left, thus facilitating work with harrows, drills, binders, etc., but requiring good well-drained soil. It can be performed in two ways:—

1) The *ordinary method* (the most used in Europe) consists in successively turning parallel furrows, by moving backwards and forwards be-

---

(1) Hilling-up (used for maize and other hoed crops) can be considered as a derivation of both the above-mentioned systems, rather than as a special method, as it first requires the land to be worked uniformly, the hills being thrown up afterwards, usually with double-breasted ploughs.

tween the headlands. It is also practised on hilly land, as the furrows can all be thrown down-hill. It requires ploughs that can alternately turn the soil to the right (going) and left (returning) as with one-way, balance, and double Brabant ploughs.

2) *The Felleberg method* requires uninterrupted furrows, obtained by keeping the plough turning continually in the field, either from the headlands towards the centre or vice versa. With this method there are thus curved furrows at the corners of the field, therefore leaving small triangular areas unploughed. It evidently necessitates the use of the common single-breasted plough (turning either to the right or left) as in the ordinary motor- or traction-ploughs.

The same type of plough can be used for making ridges, either by gathering-up or casting. This method is too well known to necessitate a description, but, on account of its importance, it will be considered later.

1) **ORDINARY PLOUGHING WITHOUT RIDGES.** — This can be done on land of any shape or size and requires no special setting-out of the land, but the following precautions should be observed: —

a) The furrows should be turned parallel to the longest side of the field, to reduce the number of turns at the headland. However, it may be better to sacrifice the long furrow for the advantage of having the

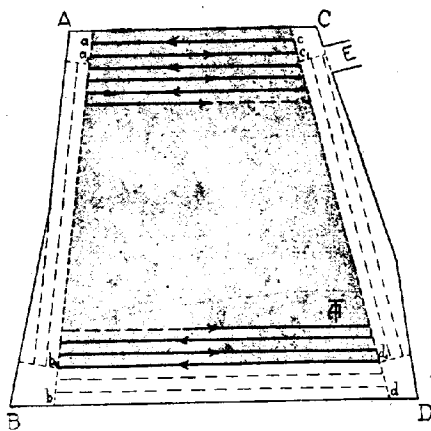


Fig. 1. — Furrows between two parallel sides of an irregular field.

furrows between two regular and parallel sides, as in Fig. 1, so as not to leave wedge-shaped pieces that would have to be finished with a team or by hand.

b) In this case it is best not to carry the furrows up to the irregular lines  $AB$ - $CD$  of the other ends of the field, but rather to stop them on the rectilinear line  $ab$ - $cd$ , so that the work will be easier to finish, either with a team or with the machine itself.

c) The entrance into the field should never (as in any system of ploughing whatever) be forgotten, and the order of the work should be subordinated to it so that, when the work is finished, the machine does not need to pass over the ploughed ground. Thus in the case of Fig. 1, where  $E$  is the entrance to the field, the ploughing will be commenced at  $ac$ ,  $a, c, \dots$  up to  $b, d$ , that is, at such a distance from  $BD$  as will allow the machine or the team to pass to finish the headland  $b, d$ - $BD$ . Afterwards, the headland  $ab$ - $AB$  is first ploughed, then the strip  $b, d$  -  $bd$  and finally the headland  $cd$  -  $CD$ , the machine leaving the field at the entrance  $E$ .

By ploughing without ridges, the whole of the field can be ploughed, save the small areas at the ends of the headlands necessary for the machine to turn in, proportional to the width of the headlands (1) and which are worked by hand.

When balance ploughs are used the width of the headland is approximately equal to the distance between the two extreme, opposite ploughs. In the case of turnwrest ploughs and double-Brabants, it depends on the breadth of the always-necessary *double, or figure-of-8, turns* that the machine can take, providing that it is not a question of machines with a central gripping-drum, which, up to a certain point, can turn on themselves.

2) FELLEMBERG PLOUGHING. — As is well known, it is difficult to turn perfect furrows on a curve so that this system is not advisable in all our soils (in Italy) where the ploughing is usually heavy and deep, the earth being turned over as evenly as possible.

On the other hand this system is much used in America where the large regular spaces, the friable, light soils, and the shallow ploughing, give a certain liberty as regards beginning ploughing, and where rapid work together with the maximum yield from the machine are required rather than regular and perfect ploughing.

With this system the time lost in turning when not working is certainly at a minimum (theoretically it should be nil), as the fatigue caused by turning when working is also minimised, but, on the contrary, very large triangular plots (the size of which increases with the size of the field and the acuteness of the angle) are left in the corners of the field, thus necessitating their being worked with a team or by hand, or even, if so desired, with the machine, but with a great loss of time.

(1) The headlands are best not ploughed with cable-hauled machines, but rather with a team. But if this is required a free strip should be left along  $AC$ , so that the machine can leave the field with the anchors or anchor-waggon, etc.

In order that ploughing may proceed normally and uninterruptedly the field should first be carefully and visibly marked out (by poles, plaster, furrows, etc.) to show the points and geometrical lines symmetrical to the sides of the area and indicating any changes in direction of the furrows.

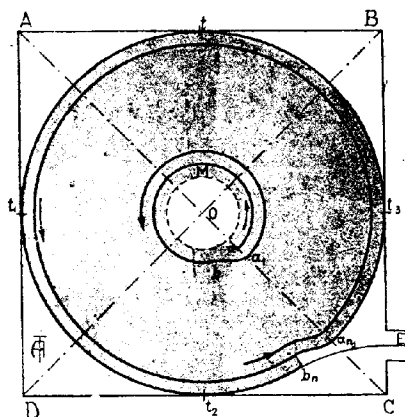


Fig. 2. — Felleberg method: application to a square field.

As an example of this procedure let us take a four-sided equilateral field (square or lozenge-shaped) as in Fig. 2. After finding the centre  $O$

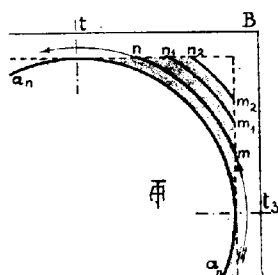


Fig. 3. — Felleberg method: finishing the corner of a square field in decreasing arcs.

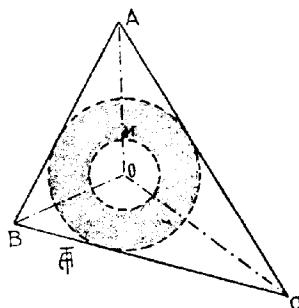


Fig. 4. — Felleberg method: application to a triangular field.

of the field (where the diagonals  $AC, BD$  intersect) a circle  $OM$  is described equal to the maximum turn possible to the machine. Then, round this

circle ploughing is begun, at  $a$ , for example, in a circle concentric to  $O$ . When the machine has arrived at  $b$ , near the starting point  $a$ , it is turned outwards by a distance equal to the breadth of the gang, and the second circle concentric to  $O$  is started at  $a_1$ , and so on, up to the last circle,  $a_n$ , at a tangent to the edge of the field. The spaces in the circle  $OM$  and the triangles  $A, B, C, D$ , are then worked, either by hand, with a team or the machine itself according to their area. In the last two cases sufficient space should be left by the last circle  $a_n$  between the last furrow and the edge of the field to allow the machine, etc., to pass from one corner of the field to another in order to plough the decreasing areas  $mn, m_1 n_1, \dots$  (Fig. 3) at each angle (1).

The procedure is similar in the case when the field is triangular (Fig. 4); the centre  $O$  is at the point of intersection of the bisectors of the angles  $A, B, C$ , but the plots left unploughed are larger owing to the acuteness of at least 2 angles.

If the field is rectangular or rhomboidal (Fig. 5), the points where the bisectors of the angles  $A, B, C$ , intersect are at  $M, N$ . The line  $MN$  is the line of symmetry of the field, and should be visibly marked in a rectangle formed by the lines  $ab, cd$  perpendicular to the parallel sides of the field.

Then, with  $M$  and  $N$  as centres, the half-circles  $b_1 C_m a_1$  and  $c_1 C_n d_1$  (2) with the radii  $MC_m$  and  $NC_n$  respectively and the lines  $ad$  and  $bc$  are marked on the ground, and ploughing of the zone enclosed by these lines is begun as shown in Fig. 6. After opening the median furrow  $C_m C_n$  on the line of symmetry, with an ordinary double breasted plough, ploughing is begun, and furrow 1 is turned throwing the soil to the right. When the limit marked by the half-circle  $a_1 C_m b_1$  is reached the gang is lifted and a figure-of-8 turn made in the direction of the arrow, to open furrow 2 on the return, always throwing the soil to the right and so on, until the machine arrives at  $d_1$ , when the ploughing becomes continuous, turning around the part already ploughed (shaded area of Fig. 5) to complete the work.

Some authors (3) advise a procedure shown in Fig. 7: the first furrow is started at  $M$ , and, at  $N$ , the machine is turned to the right, ploughing a small curve  $Nn$ ; the ploughs are then lifted and a figure-of-8 turn made to return to  $n$ , when the machine ploughs along the line  $n N_1 M_1 m$ ; at  $m$

(1) This method recalls to mind the following very original one, known now for some years, but unsuitable for large areas:—a cable attached to the machine was rolled round a strong post planted firmly in the centre of the field; as the machine advanced, it tended to move in a straight line but, being held by the cable, it was obliged to turn round the post unrolling the cable, and ploughing in the fashion of an Archimedean spiral instead of concentric circles.

(2) To speak exactly, the machine, in describing the curves on starting from the straight line, describes spirals rather than circles.

(3) See "Farm Power", published by the INTERNATIONAL HARVESTER CO., of Chicago. — *Journal d'Agriculture pratique*, 1917, No. 6. — *Le Genie rural*, 1917, No. 66. — See also *R.*, 1917, No. 574.

the ploughs are again lifted, and another figure-of-8 turn made to return to  $n$ , and so on, until having reached the minimum turning radius of the machine at  $c_1$ , it ploughs round the plot already ploughed, as in Fig. 6, that is, it successively describes the half-circles concentric to  $M$

*Fellemberg method.*

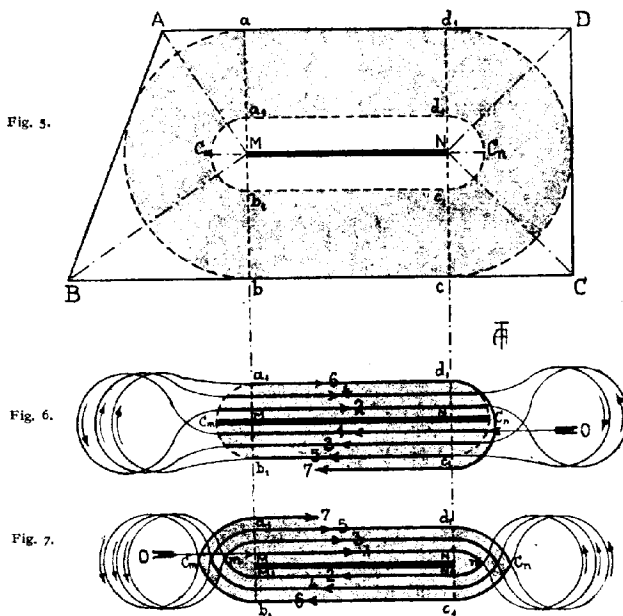


Fig. 5. — Application to a trapezoidal field.

Fig. 6. — Preparation of internal area without ploughing in curves.

Fig. 7. — Preparation of internal area by ploughing in curves.

and  $N$  (Fig. 5) and the straight furrows between  $ab$  and  $cd$ . In any case this procedure makes it very difficult to plough on the curved lines  $Nn$ ,  $nN_1$ ,  $M_1m$ , . . . . . without considering the fatigue caused by the continual double turns at the end of the furrow (1).

(1) In cases such as Fig. 5, some authors, particularly BERTHAULT (cf. BARRAL and SAGNIER, *Dictionnaire d'Agriculture*, Vol. III, p. 412), have proposed the following method

As is shown in Fig. 5, and as would be expected, the *dead* angles, i. e., these remaining to be ploughed, are all the narrower as the maximum radius of curvature  $Ma$  is smaller. It will, therefore, be seen that it is advisable to consider a field as composed of a num-

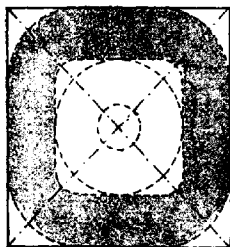


Fig. 8. — Ploughing the internal square by the method of fig. 2.

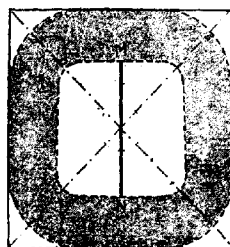


Fig. 9. — Ploughing the internal square by the method of fig. 5.

ber of rectangular or rhomboidal plots and to plough each of them successively. Thus, the square piece in Fig. 2 can be considered as made up of 2 rectangular plots  $AB_{11}D$  and  $BCI_{11}$ , which should be ploughed separately according to the method described above. Again, the field may be considered to be divided into 2 squares, one inside the other, the internal square being ploughed first, either by the method shown in Fig. 2 (Fig. 8) or by that shown in Fig. 5 (Fig. 9), being continued by the Fellenberg method round the square.

Fig. 10 shows the case of an irregular 4-sided field. After finding the bisectors of the 4 angles and their points of intersection  $M$  and  $N$ , parallels to the sides  $BC$  and  $AD$  are drawn to meet the bisectors of the respective angles  $C$  and  $D$  in  $c$  and  $d$ , thus forming the triangle  $Mcd$ . From the apices of this triangle the lines  $Ma$ ,  $Mb$ ,  $cc_1$ ,  $cc_2$ ,  $dd_1$ ,  $dd_2$  are drawn perpendicular to the sides of the triangle, then, with  $M$ ,  $c$ , and  $d$  as centres, arcs of a circle contained between these perpendicular are drawn, completing the triangle  $OPQ$ . For the interior of this triangle, with  $N$  as centre, the procedure is that of Fig. 4, then all outside the triangle up to the edge of the field is ploughed.

4 ploughing, starting, from outside: — at 1 metre from the bisectors and the median line, parallel lines are drawn on each side enclosing headlands 2 metres wide. The first furrow is turned along the edge of the field and then the work gradually proceeds upwards in straight decreasing furrows, while the ploughs are lifted or earthed at each angle turn at the headlands, which are finally split again. This method, however, does not observe the principle of *continuous* labour proper to the Fellenberg system, and, moreover, it necessitates heavy work at the turns and it results in leaving triangular areas between the bisectors that have to be worked by hand.





SECOND PART  
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

950 - **Facilities accorded to Official Agronomists for the Purchase of Automobiles, in Canada.** — SAVOIE, F. N. (Secretary, Ministry of Agriculture), in the *Journal of Agriculture* (Organ of the Minister of Agriculture for the Province of Quebec), Vol. XXI, p. 180; Quebec, June 15, 1916.

As farmers are asking more and more the aid and advice of the official agronomists, the Minister of Agriculture for the Province of Quebec has authorised all the agronomists to buy an automobile to facilitate their work. In order to encourage the agronomist to take care of the machine he has the choice between 2 systems of purchase: — 1) annual repayments of 20 % + 6 % interest on the cost price; 2) immediate repayment of  $\frac{2}{3}$  the cost price.

In both cases the automobile remains the property of the agronomist; the annual licence, fire insurance, running costs (petrol, oil, repairs), are paid for by the Ministry. The systems are based on a buying price of \$1 200.

The agronomist has to keep an account of his expenses and the monthly mileage covered on official work.

Both systems were tried in 1917, with satisfactory results.

Some agronomists have travelled more than 10 000 miles. Four chose the repayment by annual amounts, the rest preferring that by  $\frac{2}{3}$ .

951 - **On the Possibility that Man can Live on a Diet Containing No Fat; Researches in Denmark.** — *Ugeskrift for Lægerne*, Year 63, No. 22, pp. 296-298. Copenhagen, May, 1918.

Previous researches aiming at ascertaining if there is a minimum of fat required in the human diet have lead to the general conclusion that man cannot live without a certain quantity in his diet, otherwise he will become unhealthy and may even endanger his life. Physiologists are not agreed as to the exact daily minimum of fat required by the human being for continued well-being. VOIT fixed the amount at 56 gm., TIGERSTEDT at 80 or 100 gm., while SOPUS TORUP also indicates the latter figures and says that, during the present war, a characteristic unhealthy state has

[Abstract Nos. 950-951]

appeared which he calls "fedthunger" (fat hunger) and which has appeared in those countries where there is a shortage of fats, a state resembling that of Nansen's companions in the Greenland expedition. Numerous researches, using rats, have been made in the United States on this subject; when the rats received a diet absolutely free from fats, they became diseased, recovery being obtained on giving them the substances that were lacking. But the substances under question acted specifically in this case, some having a positive action, *i. e.*, producing recovery (fat from butter, egg yellow, liver oil, etc.), while others (fat from pig, olive oil, almond oil, etc.) did not bring about recovery or the return of the animals to the normal state. It was concluded that the effect was not due to the fats themselves, and that it was once more a question of "vitamines" (1).

In order to obtain more definite information on the subject, Dr. HINDHEDE made some observations on two strong, healthy persons, one a gardener, aged 31 years, and the other a student, aged 24 years. The subjects received, for more than a year, a diet "practically" free from fats, consisting of bread, potatoes and vegetables, variation being obtained by introducing, at stated periods, sweetened gruel. The two subjects were kept in very good condition while they were fed on bread, potatoes and vegetables; on the contrary, however, they lost flesh when the vegetables were replaced by the sweetened gruel. HINDHEDE admits that young, robust persons can live in perfect health for 16 months (and more, as the experiment is still in progress) on a diet of bread, potatoes, cabbages, rhubarb and apples, while a diet composed exclusively of sweetened gruel could apparently not be tolerated for more than a month. He therefore concludes that the different vegetables contain vitamins similar to those found in fats, and that the latter can be very well dispensed with provided they are replaced by vegetables. This also explains the insufficiency of the sweetened gruel. Owing to present circumstances the diet in Germany is characterised by penury of fats; although, generally speaking, the effects of such a state of affairs have not been so serious as might have been supposed, certain unhealthy conditions have appeared, contrary to the observations of HINDHEDE, amongst which is that called "Kartoffelkrankheit" (potato disease) by DÖLLNER; but it appears that this disease was cured by adding vegetables to the potatoes. Similarly, HINDHEDE attributes all the unhealthy conditions produced in Germany by the lack of fats to the lack of vitamins in the food. He thinks that there is no great need of alarm at the prospect of an eventual total lack of meat and fat, provided that care is taken to supply sufficient seeds, potatoes and vegetables.

In conclusion, HINDHEDE deduces some observations of practical value from his thesis. Those who have little land should devote as much as possible of it to market-gardening. In this way it has been calculated that Denmark could maintain 20 million individuals, if the live stock industry were suppressed. Although the exclusive growth of plants

(1) See *R.*, July, 1918, No. 710. (*Ed.*)

is not desirable and as these deductions are obviously as yet insufficiently sure to allow of their practical use, they are of great interest from the physiological point of view in that they apparently show that the human being can, without much risk, do without fats during a certain period.

952 - **The Feeding of Cattle and "Barlow's Disease" in Children Caused by Milk.** — *Nordisk Mejeri-Tidning*, Year XXXIII, No. 24, p. 284. Stockholm, June, 1918.

"Barlow's disease" so resembles scurvy that it is often called infantile scurvy. It appears in children fed exclusively on sterilised and boiled milk. It is obvious that the time required in heating milk has an influence on its vitamine content. Moreover, it is generally believed that milk is richer in vitamins during the summer when the fodder given to the cattle is fresher, than in winter when they chiefly feed on dry fodder. On the other hand, if roots are fed heavily in winter, milk might be produced that is richer in vitamins than the milk usually produced during that season, and thus have the effect of rendering the appearance of Barlow's disease more rare.

In any case, it is safest to pasteurise milk for children at a low temperature, the best method being to heat the milk for 30 minutes at 63° C.

953 - **Bacterial Precipitins and the Detection of *Bact. botulinus* in Preserved Foods by the Thermo-Precipitation Method.** — See No. 1047 of this Review.

954 - **Investigations into the Possibility of Calculating the Experimental Error in Field Experiments.** — GORSKI, M. and SREBANYI, M. (Landwirtschaftliche Hochschule Dublany bei Lemberg), in *Die landwirtschaftlichen Versuchsstationen*, Vol. XC, Pt. 3 and 4, pp. 225-240. Berlin, 1917.

Recently the experimental error has been calculated in field experiments in many different places, but without much attention being paid to the possibility of its practical application.

Practically the only important works on this subject are: — 1) that of TH. PFEIFFER and E. BLANCK (*Die landwirtschaftlichen Versuchsstationen*, Vol. LXXXIII, p. 331, 1914) in which, according to the authors, too few experimental plots were used; 2) the investigations of TH. REMY (*Landwirtschaftliche Jahrbücher*, Vol. XLIII, p. 453, 1912), which are not very conclusive because not carried out under consistent conditions; 3) the important, but little known work of F. ZALESKI (*Anleitung zur Ausführung vergl. Versuche mit verschiedenen Zuckerrübensorten*, aus dem Polnischen vom Verfasser übersetzt, 2. Ausgabe, Krakau, 1912), which, unfortunately has not been completely published; 4) the very exact investigations of TULAIKOV (*Journal Optnoi Agronomii*, 1913); 5) P. EHRENBURG's study (*Die landwirtschaftlichen Versuchsstationen*, Vol. LXXXVII, p. 29, 1915), in which the author, basing his own experiments on those of W. B. MERCER and A. D. HALL (*Journal of Agricultural Science*, Vol. IV, p. 107, 1911) (1) shows clearly the agreement of the results obtained with the theory of the least squares: however, in spite of the abundant data EHRENBURG considers his work to be

(1) See R., January, 1912, No. 29. (Ed.)

only an attempt to prove that the experimental error may be calculated in field experiments; he believes the results obtained in the field to follow in general GAUSS' law, so that the calculation of the experimental error may be applied to them. Nevertheless, he considers it necessary to collect more abundant data before the possibility of applying such a calculation to field experiments can be scientifically assured.

In order to supply further control data the authors carried out new investigations and experiments in the grounds of the "Landwirtschaftliche Hochschule" (Agricultural College) of Dublany, near Lemberg, Galicia, in a series of 200 plots of sandy loam soil and 300 plots of loess soil. The plants used were oats.

The arithmetical mean of the crops obtained from each plot, 10.76 square yards in size, was first taken, and the deviation from this average determined for each plot. The experimental error was then calculated by the formula  $r = 0.674 \sqrt{\frac{\sum v^2}{n-1}}$ , where  $r$  represents the probable error,  $\sum v^2$  the total of the squares of all the deviations without considering their sign, and  $n$  the number of observations.

RESULTS. — Those of the first set of experiments, in sandy loam, agree very well with GAUSS' law of errors. The number of positive and that of negative deviations are practically equal, and the extent of the deviation agrees well with the values calculated. If the extent and the sign of the deviation are considered together, a satisfactory agreement with GAUSS' law is also found.

In the second set of experiments, in loess, there is a yet better agreement between the deviation found and that calculated. On the other hand there is a certain disagreement between the deviation sign; instead of 150 positive and 150 negative deviations, there are 139 of the first and 161 of the second. The difference is, however, not sufficiently large for it to be said that the deviations do not follow GAUSS' law, as this can only be fully applied to an infinite set of observations.

The experimental errors (deviations from the average) in the two sets are accidental errors, to which the theory of the experimental error may well be applied. This does not, however, hold good for all field experiments, but it may be admitted that, in experiments carefully carried out in homogeneous soil, the errors which occur are only accidental.

955 - **Agricultural Experiment Stations of Canada.** — I. *The Canada Year Book* 1916-17 pp. 236-249. Ottawa, 1917. — II. *Dominion Experimental Farms; A Guide to the Experimental Farms and Stations.* Ottawa, 1912. — III. *Annual Reports of the Experimental Farms and Stations.* Ottawa. — IV. *The Agricultural Gazette of Canada.* Ottawa. — V. *Bulletins, pamphlets, circulars of the Dominion Experimental Farms Branch.* Ottawa.

In Canada there are the Dominion Experimental Farms and Stations administered by the Experimental Farms Branch of the central Department of Agriculture of the Government of the Dominion and the Provincial Colleges, Schools and Departments of Agriculture which also conduct agricultural experiments.

DOMINION EXPERIMENTAL FARMS AND STATIONS. — Under the Experimental Farm Stations Act, 1886, were established a Central Experimental Farm at Ottawa for Ontario and Quebec, and four branch Farms:— 1) for the Maritime Provinces at Nappan, Nova Scotia; 2) for Manitoba at Brandon; 3) for the North-west Territories at Indian Head, Saskatchewan; and 4) for British Columbia at Agassiz. After these five Farms had continued in operation for 20 years, the first steps were taken towards their extension in number by the establishment of new Experimental Stations for Alberta, viz., one at Lethbridge in 1906 and the other at Lacombe in 1907. Since this date development in the number of the Farms and Stations, and in the work carried on by them, has been rapid and continuous; and every province has now one or more Farms or Stations. The five original farms established in 1886 are known as "Experimental Farms", those added since are styled "Experimental Stations"; no distinction in the work is expressed by these titles.

*Dominion Experimental Farms and Stations, 1916.*

Farms or Stations	Province	Acreage	Date established
Central Farm, Ottawa . . . . .	Ontario	467	1886
Capuskasing Station . . . . .	"	1,000	1916
Charlottetown Station . . . . .	Prince Edward Island	100	1909
Nappan Farm . . . . .	Nova Scotia	300	1886
Centville Station . . . . .	"	294	1912
Frederickton Station . . . . .	New Brunswick	520	1912
St. Anne de la Pocatière Station . . . . .	Quebec	340	1911
Cap Rouge Station . . . . .	"	339	1911
Lennoxville Station . . . . .	"	455	1914
Spirit Lake station . . . . .	"	200	1916
Brandon Farm . . . . .	Manitoba	625	1886
Worden Station . . . . .	"	280	1915
Indian Head Farm . . . . .	Saskatchewan	680	1886
Southern Station . . . . .	"	650	1908
Wott Station . . . . .	"	520	1910
Lacombe Station . . . . .	Alberta	850	1907
Lethbridge Station . . . . .	"	400	1906
Vermerre Station . . . . .	British Columbia	53	1912
Sumnerland Station . . . . .	"	550	1914
Agassiz Farm . . . . .	"	1,400	1886
Sydney Station, Vancouver Island . . . . .	"	125	1912

Summing up, in 1916 there were altogether 21 Farms and Stations with an increased acreage over 1915 of 2,213, or a total average of 11,148, as compared with the original five Farms, having a total area of 3,472 acres.

Ranging over the whole of the wide fields of agriculture, arboriculture and horticulture, the work of the Farms has included experiments and studies relating to the breeding and feeding of farm live stock, the production of butter and cheese, field crops, natural and artificial fertilisers,

cereals, grasses and other forage plants, fruits, vegetables, plants, trees, plant diseases and injurious insects. The Farms are also bureaux of information to which agriculturists resort for practical advice. In addition to the farms and stations included in the foregoing table there are 7 small substations at Salmon Arm, British Columbia, at Fort Vermilion, Grouard and Beaver Lodge in Alberta, and at Forts Smith, Resolution and Providence, in the Northwest Territories.

The more strictly scientific side of the work is carried on at the Central Experimental Farm at Ottawa, and is organised in thirteen divisions as follows: — 1) Field Husbandry; 2) Animal Husbandry; 3) Horticulture; 4) Cereals; 5) Chemistry; 6) Forage Plants; 7) Botany; 8) Poultry; 9) Tobacco; 10) Economic Fibre; 11) Illustration Stations; 12) Apiculture; 13) Extension and Publicity. What was formerly the Entomological Division became in 1914 the separate Entomological Branch of the Department of Agriculture.

Only brief mention is possible of the more striking results already achieved, with some indication of the work now being carried on. In the field of *General Agriculture*, the importance of early sowing was demonstrated by a series of experiments which lasted from 1890 to 1899. As the result of experiments on the branch Farms in the West, the practice of summer fallowing for the conservation of moisture and the destruction of weeds is widely followed in the Prairie Provinces. Experiments continued from 1893 to 1910, have shown over large areas in Canada the economic advantage of applying fresh as compared with rotted farmyard manure. In the *Cereal Division*, notable work has been done in the production of new varieties of grain, especially wheat possessing the qualities of productiveness, an early ripening habit and good baking strength. Varieties of wheat known as Preston, Stanley and Huron are all vigorous and productive, and ripen early; but the variety that has achieved the greatest success is the Marquis, which is equal to Red Fife in baking qualities, ripens from 5 to 10 days earlier and is superior in productiveness. It is now rapidly superseding Red Fife throughout the Northwest.

Experiments carried on over a series of years by the *Field Husbandry Division*, show the advisability of a rotation which includes a cereal crop, a hay crop (including clover) and a root crop. In the *Division of Animal Husbandry*, extensive breeding experiments are in progress. Important work has been done in the demonstration of effectively ventilated stables and cow barns. The *Division of Horticulture* carries out numerous experiments with apples, plums, cherries, grapes, small fruits and vegetables. Many varieties have in past years been tested, and promising seedlings for different latitudes have been recommended to growers. The object of the experiments with apples has been to obtain, by cross fertilisation and selection, new varieties that will stand the severe winters, also varieties of better keeping qualities. Experiments were begun in 1915 to test the possibility of growing root and vegetable seeds in Canada instead of importing them from abroad. So far as they have gone, the experiments have proved successful and are being continued. In the *Division of Botany*,

investigations of the diseases of cultivated plants are carried on, and advice is given as to remedial measures wherever possible. Weeds are identified and methods of eradication recommended. Wild plants from all parts of Canada are received for identification, and information is furnished as to whether they are edible, medicinal or poisonous. Tests are also made as to the suitability of the climate of Canada for the growth of various plants of economic importance, such as fibre plants (flax, hemp), medicinal plants (opium-poppy, anise, etc.), oil-yielding plants (castor oil, soy bean), and miscellaneous plants (mustard, chicory, etc.). Much has been accomplished in *Arboriculture* not only by setting apart 65 acres at the Central Experimental Farm for the testing of trees and shrubs from all parts of the world, but also by the encouragement given to tree-planting in the western provinces.

The *Division of Chemistry* covers a large field, and the Dominion Chemist, who is also Assistant Director of the Farms, controls a staff of nine fully qualified chemists. Investigations have been conducted to determine the nutritive value of fodder plants by analyses at different stages of their growth. Canadian grown cereals have been analysed to ascertain their quality and nutritive value, and the straw has also been examined to determine its value as fodder. Analyses have been made of soils from different parts of the Dominion. Investigations have been made into farmyard manures. Many experiments have been conducted to throw light on the factors affecting soil moisture, and means have been suggested whereby the desired conditions of moisture may, to a great extent, be obtained and controlled by cultural operations. The influence of environment on the composition of wheat has been studied since 1905, and the work has now been enlarged, through co-operation with the Dominion Meteorological Service at Toronto, to secure a more comprehensive and detailed study of the relationship between weather conditions and crop growth. Analyses of sugar beets have been useful in demonstrating the suitability of soil and climate at widely different points of the Dominion for the growth of roots of high sugar content and purity. Well waters from farm homesteads have been the subject of special study. Numerous analyses are made in conjunction with problems relating to the land, the crop and the animal which from time to time are submitted by farmers for solution. Analyses are also made of dye stuffs, preservatives, pickling solutions, etc., and systematic investigational work with commercial fertilizers is now being carried on. Owing to the scarcity of potash caused by the European war, the preparation of a nitro-potassic fertiliser by the drying and grinding of seaweed was undertaken at a point on the coast of Nova Scotia. The fertilising value of the material so prepared is being tested in the field.

The *Poultry Division* undertakes experiments in the breeding, etc., of farm poultry. Demonstrations in poultry keeping are made, chiefly for the purpose of proving locally that farm poultry rather than the poultry farm is profitable.

Experiments in the growth of *tobacco* are carried on by an expert

from France at Ottawa, assisted by local superintendents at the tobacco stations of St. Jacques l'Achigan, and Farnham, Quebec and Harrow, Ontario. In 1912 a *Division of Forage Plants* was established under the direction of a scientific officer from the Plant Breeding Station at Svalöf in Sweden. The Division has for its object improvement in the quality and yield of grasses, clovers, alfalfas and other forage crops grown in Canada. An Economic Fibre Division was established at Ottawa early in 1916 to investigate the possibilities of the flax fibre industry in Canada. Hemp growing is also being tried.

*Illustration Stations* were started in 1914 by the selection of small areas at different points in Saskatchewan and Alberta, the object being to show to farmers in the district selected the best cultural and crop methods. Early in 1915 the Illustration Station work inaugurated by the Commission of Conservation was taken over by the Experimental Farm Branch. In 1915 a *Division of Extension and Publicity* of the same Branch was formed for the purpose of making the work of the Experimental Farms more widely known amongst the farmers of Canada. The Division issues every four months a publication entitled "Seasonable Hints", which gives timely notes and advice to help the farmer in his current work.

PROVINCIAL AGRICULTURAL EXPERIMENTS. — In *Nova Scotia* at the College of Agriculture, Truro, about 400 acres are devoted to general farming and gardening and to investigations (application of ground limestone; fertiliser experiments; experiments with varieties of oats, wheat, barley, etc.; feeding experiments; influence of various stocks of the apple on the scion; collection of cherries and plums; variety tests of strawberries; hill selection of potatoes; etc.); experiments are also conducted in the chemical, entomological and botanical laboratories.

In *Quebec* the Macdonald College, Ste. Anne de Bellevue, comprises 786 acres divided as follows: — main farm, 584 acres; cereal husbandry plots, 75 acres; poultry department, 17 acres; orchards, 35 acres; vegetable gardens, 25 acres; recreation fields, 50 acres. Experiments are carried on in animal husbandry, cereal husbandry, poultry, chemistry, bacteriology, horticulture, biology and physics. The Oka Agricultural Institute is one of the oldest experimental farms in Canada; a large number of dairy cattle are kept and experimental work is carried on with these and with swine, poultry and bees; horticulture is practised largely; the growth of small fruits is a speciality and the vineyards are celebrated. The School of Agriculture, Ste. Anne de la Pocatière, owns more than 500 acres of land, where besides general cultivation a number of experiments are also carried on.

The *Ontario* Agricultural College and Experimental Farm, Guelph, were established in 1874 to train young farmers in the science and practice of agriculture and to conduct agricultural experiments for the benefit of the province. Research and experimental work is conducted in the departments of field husbandry, animal husbandry, horticulture, chemistry, dairy, poultry, physics, bacteriology, entomology, botany and apiculture.

In *Manitoba*, at the College of Agriculture, Winnipeg, field husbandry



experimental work was inaugurated in the spring of 1915 and was divided into 3 divisions:— cereal crops; forage crops; soil and crop management.

The College of Agriculture, Saskatoon, *Saskatchewan*, has a farm of 880 acres which is devoted to diversified agriculture; investigations are being made to ascertain the carrying power of prairie lands under different crops for the production of meat and milk; in grading up farm flocks from the common range ewes; cheap housing for sheep, swine and poultry; in silage production from crops other than maize, such as oats and peas, sweet clover, alfalfa; another section has been set aside for investigations in tillage, crop production, crop improvements, variety tests and rotations; the effects of different artificial fertilisers with farmyard manure are being tried; garden and fruit crops, trees, shrubs and flowers are being introduced for the purpose of testing varieties and methods of management, under prairie conditions.

A College of Agriculture has been established at the new University of *Alberta*, Edmonton South, where at present over 100 acres of land are available for experimental work in cereals, grasses, clovers, hoed crops, small fruits, vegetables and flowers; work is being started with soils and excellent foundation stock has been secured in pure-bred cattle, sheep and hogs. Experimental work at each of the three provincial Schools of Agriculture at Paretholm, Olds and Vermilion has been carried out by the *Alberta* Department of Agriculture since October, 1914.

Finally experiments are being carried out by the Live stock and Horticulture branches of the *British Columbia* Department of Agriculture; the Live Stock branch is conducting one experimental plot of 13 acres, another of 10 acres, 11 plots from 4 to 5 acres and 6 one-acre alfalfa plots; work in drainage and the correcting of soil acidity is being carried out in one plot; where plots are located in newly-settled districts, the work partakes largely of tests to determine the best crops and varieties for local conditions; on other plots a rotation system suitable for the district represented is being established, and as far as possible the work is carried on in co-operation with the local Farmers' Institutes, and where practicable the plots are used as a centre of good seed production; the horticultural branch too is operating vine demonstration and experimental orchards of five acres each, which are planted and cared for under a co-operative arrangement by which the owner of the land and the Department share the expense, the agreement covering a five-year period, but in some cases further agreements are being made.

At the University of *British Columbia* the experimental results obtained by the Department of Agronomy during 1915-16 with all classes of field crops have proved of great value in determining the best methods of bringing heavily timbered uplands under cultivation; the allotments of land made to the Departments of Agronomy and Horticulture are being specially prepared for investigational work, and in Animal Husbandry special attention will be given to feed problems in connection with cattle, swine, sheep and poultry; over 25 000 specimens of the native flora of the province, representing nearly 800 species, have been transferred to the

Botanical garden and constitute the most representative botanical collection of British Columbia.

## CROPS AND CULTIVATION.

956 - Chemical Composition, from an Agricultural Point of View, of Rainwater Collected at Montevideo, Uruguay, from 1909 to 1912—SCHROEDER, J., in the *Revista del Instituto Nacional de Agronomía de Montevideo*, Ser. II, No. 1, pp. 27-48. Montevideo January, 1918.

In a previous report (*Revista del Instituto N. de Agronomía*, Montevideo, 1910, No. 7, p. 123) the author published the results of his observations on the carbonic acid content of the air at Montevideo. These results showed that the amount of the gas present varies greatly with the season and the direction of the wind. The average content is 2.98 volumes per 10 000 volumes of air under normal conditions, at 0°C and 760 mm.

The report under review gives a series of data relating to the amount of nitrogenous compounds, chlorides (expressed as sodium chloride) and organic matter carried to the soil by rainwater during the period 1909-1912. The work done on the chemical composition of rainwater in all parts of the world is first reviewed rapidly, and the author then gives the results of his own observations, which are summarised in tables. These observations, made at the Sayago experiment field at the Agricultural Institute of Montevideo, lead to the following conclusions:—

With a total precipitation of 1504 mm. per annum (in 1912), 1 acre of the Sayago experiment field received 6.88 lb. of combined nitrogen, of which 3.28 lb. was ammoniacal and 3.60 lb. nitrous and nitric. At the end of 24 months of observation (May to September, 1908; October, 1911 to February, 1913) the same area received 7.03 lb. of ammoniacal nitrogen and 6.09 lb. of nitric nitrogen, *i. e.*, 12.23 lb. of nitrous and nitric nitrogen, or 6.10 lb. per acre annually. The nitrogen content of rainwater of 18 tropical countries and of 96 temperate countries (50 observations) is given. A comparative examination shows that the figures obtained at Sayago are slightly higher than those for the tropical and temperate countries.

The author was unable to prove that the seasons had any influence on the amount of nitrogen, which, moreover, he thinks only worth considering as a source of nitrogen for agriculture. The quantity of chlorides (expressed as sodium chloride) carried to the soil by rainwater is 73.60 lb. per acre. The chloride content of the rainwater seems to depend on the direction of the wind while the rain is falling.

The amount of organic matter (calculated in milligrams of oxygen required to burn it) was on an average 750 mgm. of oxygen per 1 000 litres of rainwater. The evaporation residue of rain is, on an average 303 lb. per acre annually, of which 108 lb. disappear on burning and 195 lb. form a non-volatile residue.

In conclusion the author points out that these figures refer to the Montevideo district and not the interior of the country.

- 957 - Some Notes on the Direct Determination of the Hygroscopic Coefficient. — ALWAY, F. J., KLINE, M. A. and MCDOLE, G. R., in the *Journal of Agricultural Research*, Vol. XI, No. 4, pp. 147-166 + Bibliography of 27 Publications. Washington, D. C., October 22, 1917.

The hygroscopic coefficient expresses the percentage of moisture contained in a soil which, in a dry condition, has been brought into a saturated atmosphere, kept at a constant temperature, and allowed to remain until approximate equilibrium with this atmosphere has been attained. It has a twofold significance, both serving as single-valued expression of the relative fineness of texture, and, in soil-moisture studies, permitting the approximate estimation of the maximum amount of water available for growth and for the maintenance of plant life — the difference between the total amount of water and the hygroscopic coefficient.

The error is sometimes made of confusing MITSCHERLICH'S "Hygroskopizität" with the hygroscopic coefficient as above defined. The former is determined by allowing the exposed soils to come into equilibrium with an atmosphere in contact with a 10 per cent sulphuric acid solution instead of with water, MITSCHERLICH holding that the determination by HILGARD'S method gives results much too high on account of the condensation of moisture on the exposed samples.

HILGARD'S method was described by him (Report on the Methods of Physical and Chemical Soil Analysis, *U. S. Dept. of Agr., Division of Chemistry, Bulletin* 38, 1893, pp. 60-82) as follows: —

The fine earth is exposed to an atmosphere saturated with moisture for about twelve hours at the ordinary temperature (60° F.) of the cellar in which the box should be kept. For this it is sifted in a layer of about 1 mm. thickness upon glazed paper, on a wooden table in a small water-tight covered box (12 by 9 by 8 inches) in which there is about an inch of water; the interior sides and cover of the box should be lined with blotting paper; kept saturated with water, to insure the saturation of the air.

After eight to twelve hours the earth is transferred as quickly as possible, in the cellar, to a weighed drying-tube and weighed. The tube is then placed in a paraffin bath, the temperature gradually raised to 200° C. and kept there 20 to 30 minutes (rapidity of raising temperature depending upon the amount of moisture in the soil), a current of dry air passing continually through the tube. It is then weighed again, and the loss in weight gives the hygroscopic moisture in saturated air.

Some time later, to avoid the decomposition of the organic matter of surface soils, HILGARD modified the method to the extent of using an air bath, raising the temperature to only 110° C, keeping the sample in for an hour, weighing, drying again, and continuing the process until a practically constant weight was obtained.

The authors have tested this method by studying the following points: — rapid loss of hygroscopic moisture; suitability of trays of various materials; influence of time of exposure; effect of great fluctuations in the temperature of the room; effect of grinding; influence of size of absorption boxes and the number of tables; concordance of determinations

in practice; reliability of the method described by HILGARD; modification of method when sample contains gravel or pebbles; they arrive at the following conclusions:—

The amount of hygroscopic moisture absorbed increases with the rise of temperature. Drying of mineral soils at temperature of 100° to 110° C. does not appreciably decrease their hygroscopicity. Intractable samples may be reduced in a steel mortar to pass a 1 mm. sieve without appreciably affecting their hygroscopicity.

Twelve hour's exposure in the absorption boxes is sufficient only when the soil layer is very shallow. In practice a longer interval is found more convenient, 20 to 24 hours proving very satisfactory. An exposure of more than 24 hours gives higher values only in the case of very fine textured soils.

A soil containing the amount of moisture corresponding to its hygroscopic coefficient loses water very rapidly when exposed to an ordinarily dry atmosphere, but in determining the hygroscopic coefficient the time necessary to transfer the soils from the absorption boxes to weighing bottles is so brief that the loss during the transfer is too small to appreciably affect the accuracy of the results.

HILGARD's method for the determination of the hygroscopic coefficient carried out exactly as he describes it, gives reliable results. However, the loose sheets of glazed paper used are very inconvenient when many determinations are to be made and may be advantageously replaced by shallow trays, either of aluminium or of copper. Trays of glass, graniteware, and vulcanized rubber give satisfactory results, but are less convenient, while those of tin plate or zinc, although satisfactory at first, soon corrode. Pasteboard trays lined with glazed paper give results much too low, unless the period of exposure be greatly prolonged, and even those of paraffined pasteboard lined with glazed paper give somewhat low results. Any considerable increase in the size of the absorption boxes over that recommended by HILGARD or the use of a larger number of exposed samples within the boxes of the same size cause too low results, unless the time of exposure be greatly increased.

958 - **The Relationship Between Absorption and Coagulation With Respect to the Mineral Colloids of the Soil.** — DOMINICIS, A. DE, in collaboration with CHIARERI, F. (Laboratorio di Chimica agraria della R. Scuola Superiore di Agricoltura di Portici), *Le Stazioni Agrarie sperimentali italiane*, Vol. 4, Pt. 9-10, pp. 451-479. Modena, 1917.

In two earlier papers (*Rendiconti della Società Chimica italiana*, Vol. V, p. 285, 1913; *Le Stazioni sperimentali agrarie italiane*, Vol. XLVIII, p. 525, 1915; *Annali di Chimica applicata*, Vol. IV, p. 284, 1915) the author gave the results of a series of investigations into the relationship (resulting from an objective examination of facts) between absorption and coagulation. The general plan of the investigation was to determine the relationship between that which is absorbed and that which is coagulated, considering that each time a saline solution acts on a colloidal solution the resulting coagulation always determines a lowering of the concentration of one of the electrolytic constituents of the dissolved salt. The constituent thus acted on is that which, by reason of its charge, acts on the coagulation in

such a way that, when it is not a question of colloids easily subject to reciprocal replacement (as certain zeolites and soil in general), the saline solution may become acid or alkaline, according to the circumstances. In his previous papers the author showed this relationship to exist. The present paper gives a further experimental contribution which aims at making more clear the principles derived from the interpretation of the results. The method adopted in the new investigations did not differ from that of the preceding ones and consisted of verifying whether the ratio between the monovalent alkaline metals (ammonium, potassium and sodium) also exists for the bivalent alkaline-earth metals (calcium, barium, strontium and magnesium):—1) by a study of the relationship with regard to the concentration of the active electrolyte; 2) with regard to the duration of the action of this electrolyte; 3) with regard to the absorbing power of the different metals; 4) with regard to the valency of these metals. The results, which agree with those of the previous investigations, confirm the following general principles:—

1) There is a real and constant relation between absorption and coagulation.

2) The action of the electrolytes determines a single process in the unstable hydrosols consisting of coagulation by absorption. When atoms and ions of opposite sign come into contact they attract each other reciprocally, causing the neutralisation of their respective charges and the formation of insoluble absorption combinations. This causes a lowering of the concentration either in the colloidal solution or in the electrolyte solution.

3) Considered separately, the two processes proceed in parallel, as the function of identical factors and in function one of the other, that is, they advance as the opposed signs of charge between the atoms and ions drop, and are seen to be connected by the relation of cause and effect.

4) The existence of this relation is of great importance as regards the physical-chemical properties of the soil, which are always influenced by it in a manner advantageous to fertility.

959 - **Influence of Nitrates on Nitrogen-Assimilating Bacteria.**—HILLS, T. L. (Research Bacteriologist, Idaho Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XII, No. 4, pp. 183-230 + 31 Tables + Bibliography of 40 Publications. Washington, D. C., January 28, 1918.

By far the greatest amount of work on the relation of nitrates to plant growth has been done in the realm of the higher plants. Very little attention has been given to the effect of nitrates on the lower plants, especially bacteria. Because of the relation that exists between higher plants and bacteria the author considered it advisable to study the effect of nitrates on certain groups of soil bacteria, including not only their reproduction but also some of their physiological properties. The soil bacteria studied were especially those forms concerned with the fixation of atmospheric nitrogen. The work followed two lines of investigation: First, the influence of nitrates on *Azotobacter* was determined. Here studies were made on the effect of nitrates on the growth of the organism in soil and also the effect

of these salts on the nitrogen-fixing property of these bacteria. The action of *Azotobacter* on nitrates in solution, the relation of nitrates to pigment production and to the formation of volutin bodies (1) were studied. Second, the influence of nitrates on the growth of *Bacillus radiculicola* in soil was studied. The action of *B. radiculicola* on nitrates in solution and the possible nitrogen-assimilating properties of the legume in the presence of nitrates were investigated. Also the influence of nitrates on gum production was determined. The latter part of the investigations included a study of the relation of nitrates to nodule formation on alfalfa.

The results are summarised as follows:—

1) Small quantities of potassium (10 to 100 mgm. in 100 gm. of dry soil), sodium, and calcium (10 to 150 mgm. in 100 gm. of dry soil) nitrates caused a great increase in the number of *Azotobacter* in sterilised soil. Ammonium nitrate in the same quantities caused a less marked increase. Higher concentrations were not so favourable to the growth of the organisms.

2) Potassium and sodium nitrates in the concentrations studied (as much as 150 mgm. of  $\text{NO}_3$  in 100 cc. of medium) caused an increase in the amount of nitrogen assimilated by *Azotobacter* on agar films. Calcium nitrate in the same amounts brought about a decrease in the amount of nitrogen fixed to a point even below that representing the amount assimilated in the absence of nitrates. In soil cultures nitrates of sodium and calcium caused an increase in total nitrogen, which was more marked in the unsterilised cultures than in those cultures sterilised and inoculated with a pure culture of *Azotobacter*. However, the increase in total nitrogen is not commensurate with the increase in the number of *Azotobacter* noted under the same conditions.

3) Under aerobic conditions *Azotobacter* in liquid cultures reduced nitrate to nitrite, but not to ammonia. More atmospheric nitrogen was assimilated in the presence of nitrate than in the absence of this salt.

4) Pigmentation occurred when potassium and sodium nitrates, and especially calcium nitrate, were used with *Azotobacter*, the colouration increasing with the concentration of the salt. This effect was more marked in *Azotobacter* strains which produce little or no pigment in the absence of nitrates.

5) All three nitrates studied caused an increase in the number and size of volutin bodies in *Azotobacter* cells. From all appearances these salts also tended to hasten the development of these bodies.

6) The number of *Bacillus radiculicola* in sterilised soil was increased by the addition of small quantities (as much as 50 mgm. nitrate in 100 gm.

(1) The presence of volutin bodies, or metachromatic granules in *Azotobacter* has been shown by BONAZZI. These substances, according to MEYER, are reserve food materials other than fat droplets, glycogen, and similar substances reacting with iodine stain which occur in the cytoplasm of the cells of various bacteria. With Millon's reagent they give no reaction. He believes that these bodies are composed of nucleic-acid compounds but are not nuclear proteids. (Author).

of dry soil) of potassium, sodium, ammonium, and calcium nitrates. This increase was not so marked as in the *Azotobacter* cultures. *B. radiculicola* appeared to be much more resistant to higher concentrations of nitrates than *Azotobacter*.

7) *B. radiculicola* under aerobic conditions did not reduce nitrates in solution to nitrite, ammonia, or elemental nitrogen. The presence of nitrates did not materially influence the small amount of atmospheric nitrogen fixed under these conditions.

8) When grown on agar films, *B. radiculicola* fixed a small amount of nitrogen, varying from 0.15 to 0.43 mgm. of nitrogen in 100 cc. of the medium. The addition of various amounts of potassium, sodium, and calcium nitrates increased to a slight extent the amount of nitrogen assimilated.

9) In liquid cultures all three nitrates caused a large increase in the amount of gum obtained by precipitation with acetone.

10) The presence of large amounts of potassium, sodium, and calcium nitrates proved detrimental to the formation of nodules on alfalfa. *B. radiculicola* did not appear to lose its infecting power when grown on media containing varying amounts of sodium and calcium nitrates. Alfalfa seedlings grown in the presence of large amounts of nitrate did not produce nodules when inoculated with a viable culture of *B. radiculicola*. Nitrates in soil cultures prevented the re-formation of nodules once removed and also caused a decrease in the number of nodules already present.

950 - **New Coprolite Works in the United Kingdom.** — *The Board of Trade Journal*, Vol. C, No. 1118, p. 532. London, May, 2, 1918.

The Financial Secretary to the British Ministry of Munitions recently stated in the House of Commons that the initial expenditure by his Department on the new coprolite works — on plant, wages, buildings, and railways — was £31 279. The value of coprolites produced to date was negligible, but deliveries were anticipated to commence at the end of April at a rate which would shortly rise to 1 200 tons per week, and that a total production of some 80 000 tons, of a value of approximately £280 000 would be secured.

961 - **Effect of Sulphur on Different Crops and Soils** (1). — SHEDD, O. M. (Kentucky Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No. 4, pp. 91-103. Washington, D. C., October 12, 1917.

There has recently been some discussion as to the importance and supply for plant growth of sulphur in its various compounds in soils and whether or not it may be a limiting element in crop production.

While it is one of the essential elements, the amounts found by the old method of asking plants were so low in most cases that it was generally assumed there was an abundant supply of its compounds in soils for all crop requirements. More recently, however, it has been demonstrated by improved methods of analysis that most plants contain much more sulphur

(1) See R. 1911, Nos. 1145, 1397, 3730 — 1912, Nos. 780, 1279 — 1913, Nos. 234, 478, 911 — 1914, No. 503 — 1915, Nos. 4, 60, 798, 1280 — 1916, Nos. 150, 720. (Ed.)

than was formerly thought to be the case, owing to the fact that in many instances by the old method the bulk of the sulphur was lost on ashing the plant, and therefore was overlooked. The question then arose as to whether there is an ample supplement of sulphur compounds in soils for crop needs and especially for the best growth of those which are now known to have a high sulphur content.

Some investigators contend that, although some soils are low in sulphur, lower in many cases than in phosphorus, this is compensated for by the amount brought down in the rainfall; and as a result it will never be a limiting element in crop production. There are others, however, who maintain that the sulphur brought down in the rainfall will not equal the loss of this element in the drainage. To establish the point whether the application of sulphur compounds may be beneficial for the maximum production of crops high in sulphur when they are grown on soils that are low in this element, numerous experiments have been carried out. The results were in some cases decidedly beneficial, in others indifferent and in still others injurious. In order to avoid the difficulty arising from the use of the element to be tested in combination with others — which makes the results not easy of interpretation — the writer used flowers of sulphur mixed, at the rate of 100 and 200 lb. per acre, with soil to which the necessary fertilising ingredients were added, together with calcium carbonate. Eight surface soils, taken to a depth of  $6\frac{2}{3}$  in., each representing a distinct type in Kentucky and more or less impoverished by cultivation were selected. Soybeans, clover, oats, alfalfa and wheat were grown in the greenhouse on these soils.

The results show that the sulphur increased the production of some crops, had no effect on others, and on some was injurious, depending on the crop and the soil on which it was grown. There was a preponderance of gains, however, from the sulphur application, but these were generally small.

Analyses of some of the crops show that the sulphur increased the total and sulphate-sulphur content of the plant, and the greater the application, the greater the increase. Where sulphur was applied to clover and alfalfa, the excess sulphur in those plants was in the form of sulphate, while in soybeans part of the excess was in another form. In the soybeans which showed an increased sulphur content, no corresponding increased protein content was always found. In five instances out of eight, however, soybeans grown in soil where sulphur was added show an increase in the total weight of protein.

It was found that, of the 16 varieties of field and garden seeds examined — maize, beans, cowpeas, alfalfa, millet, oats, soybeans, wheat, hemp, timothy, rye, tobacco, peas, onions, bluegrass, clover — some, the 10 last, contain sulphates while others, the first 6, do not, but that, on germinating, all except two — maize and clover — form a greater or less amount of sulphate. The highest sulphate content obtained in the ungerminated seed was 0.048 % in clover, and the increase due to germination varied from none, in maize, to 0.035 %, in the onion. There was a slight loss in only one sample, clover.



62 - **An Estimate of the Amount of Fertilisers Required for Food Production in Norway.** — *Tidsskrift for Det Norske Landbruk*, Year XXIV, No. 5, pp. 208-211. Christiania, 1917.

The Supplies Committee of the Norwegian Agriculturists' League has estimated the amount of fertilisers required in Norway for agricultural purposes to assure the food supply of that country for 1918.

In Norway 590 520 tons of grain are consumed annually; on adding the amount required for sowing the total annual amount is 659 414 tons. The annual production of grain is 344 312 tons, but it could be increased to 413 364 tons by raising the yield per acre from 13.5 to 16 cwt. There would thus be a deficit of 246 050 tons, which could be provided for (assuming a yield of 16 cwt. per acre) by bringing another 620 246 acres under cultivation to cereals, the area requiring a complete fertiliser. On the other hand, increasing the annual production by 69 052 tons would require enough fertiliser for 74 133 acres over and above the area already under cereals, so that a complete fertiliser would be required for  $308\,887 + 74\,133 = 383\,020$  acres.

Assuming that the complete fertiliser would be made up, per acre, of 134 lb. calcium nitrate with 15 % of nitrogen, 178 lb. of 16 % superphosphate and 89 lb. of potash salts containing 37 % of potash, the amount of fertiliser required to produce sufficient food to balance the production and consumption in Norway would be: — 200 039 tons of nitrogenous manures calculated as 15 % calcium nitrate; 3 051 tons of phosphatic manures calculated as 16 % superphosphate; and 15 255 tons of potassium salts containing 37 % of potash.

Normally there are 1 294 866 acres of meadowland. If the area required for cereals is subtracted from that figure, there will remain 988 440 acres of meadowland. The fertiliser required per acre will be 178 lb. of nitrate, 89 lb. of superphosphate, and 89 lb. of potash salts, which gives a total of 39 368 tons of calcium nitrate with 15 % nitrogen, 19 684 tons of phosphatic manures reckoned as 16 % superphosphate or basic slag, and 19 684 tons of 37 % potash salts.

To this estimate of the fertiliser requirements for 1918 must be added the average consumption of previous years, which, according to the statistics consists of 8 858 tons of 15 % calcium nitrate, 41 336 tons of 16 % superphosphate or basic slag and 6 988 tons of 37 % potash salts.

Summing these figures the total fertilisers required in Norway to provide for food production is 70 862 tons of 15 % calcium nitrate, 91 531 tons of 16 % superphosphate, and 41 336 tons of 37 % potash salts.

963 - **Plants Tolerating Salt.** — FENZI, E. O., in the *Bollettino della R. Società Toscana di Orticoltura*, Year XLIII, Nos. 5-6, pp. 37-39. Florence, 1918.

Salt soil and brackish water are found in South Italy and in all the larger Italian islands along the coast of Tripoli, Eritrea and Somalia. So that these soils may be cultivated the author publishes the following list compiled partly from investigations recently made in Algeria by M. J. BRICHET and partly from his own experiments: —

1). — PLANTS WHICH DO WELL IN SOILS FREE FROM CHLORIDES EVEN IF THEY ARE IMPREGNATED WITH WATER CONTAINING MORE THAN 1.5 % OF SALT (SODIUM CHLORIDE).

a) Agricultural and industrial plants. — Cotton, *Medicago arborea*, maize, sorghum (*Sorghum* spp.), tobacco.

b) Vegetables, etc. — Sorrel, garlic, beet, white beet, artichoke, cardoon, carrot, various kinds of cabbage, chicory, onion, water melon, bean, various kinds of lettuce, aubergine, capsicum, pea, tomato, leek.

c) Fruit trees. — Apricot from seed or ungrafted, quince *id.*, almond *id.*, apple *id.*, olive, pear ungrafted, plum *id.*, vines of different varieties.

d) Flowering and ornamental plants. — *Achyranthes*, *Ageratum*, amaranth of different varieties, *Antirrhinum*, *Coreopsis*, *Dahlia*, *Datura* of different varieties, *Eschscholzia*, marigold (*Calendula*), *Gaillardia*, *Gazania*, *Geranium* and *Pelargonium* of different varieties, *Iris* of different varieties, sunflower, *Mirabilis*, *Lippia repens*, camomile (*Anthemis*), *Mesembryaceae* of different varieties, poppies *id.*, *Petunia id.*, stock *id.*, *Zinnia id.*

e) Flowering and shade trees. — Laurel (*Laurus nobilis*), bitter orange, *Acacia cburnea* (= *A. horrida*), *Buddleia madagascariensis*, *Casuarina* of different varieties, *Cestrum elegans* and other species, *Duranta Plumieri*, *Muehlenbeckia platyclada*, *Robinia Pseudoacacia*, *Schinus Molle*, *S. terebinthifolius*.

II. — PLANTS CAPABLE OF GROWING AND DOING WELL IN SOILS CONTAINING NOT MORE THAN 5 % OF CHLORIDES, EVEN IF IMPREGNATED WITH WATER CONTAINING NOT MORE THAN 3 % OF CHLORIDES. — *Aberia caffra*, *Acacia cyanophylla*, *A. cyclopis*, *A. Farnesiana* and other species, *Ailanthus glandulosa*, locust tree, (*Ceratonia siliqua*), *Caesalpinia Gilliesi*, *Cupressus funebris*, *C. macrocarpa*, *Eucalyptus cornuta*, *E. robusta* and other species, *Pittosporum Tobira* and other species, *Pistacia atlantica*, *P. Lentiscus*, *P. Terebinthus*, *Parkinsonia*, *Phillyrea*, *Pinus halepensis*, *Punica Granatum*.

III. — PLANTS CAPABLE OF LIVING AND DOING WELL IN SOIL CONTAINING UP TO 5 % OF CHLORIDES, EVEN IF IMPREGNATED WITH WATER CONTAINING THE SAME PROPORTION OF CHLORIDES. — *Agave americana* and many other species, *Artemisia arborescens* and other species, *Atriplex Halimus*, *A. lentiformis* and other species, *Bupleurum fruticosum*, *Grithmum maritimum*, *Juniperus macrocarpa*, *J. phoenicea*, *Melaleuca hypericifolia* and other species, *Myoporum laetum*, *id.*, different varieties of rose bay, *Opuntia Ficus-indica* and other species, *Phoenix canariensis*, *Ph. dactylifera*, *Pircunia dioica*, *Pinus Pinaster*, *P. Pinea*, *Sabal Palmeth* and other species, *Washingtonia filifera* and other species.

As is seen, the plants of the first group tolerate moderate quantities of salt, those of the second tolerate it in fairly large quantities, and those of the third in very large quantities.

964 - **A Physical and Chemical Study of the Kafir Kernel, in the United States (1).**

— BIDWELL, G. L., in the *U. S. Department of Agriculture, Bulletin No. 634*, pp. 5 + 1 Fig. Washington, April 4, 1918.

The grain of non-saccharine sorghums have hitherto been used almost exclusively for cattle feeding, but now they are used in ever-increasing quantities as a human food and for the preparation of starch and alcohol. For this reason the Bureau of Chemistry of the U. S. Department of Agriculture made a physical and chemical study of kafir kernels, using Dawn Kafir (Dwarf Blackhull) C. I. 340. The tegument of this variety is thin, and the endosperm horny without and starchy within. It is broadly ellipsoid and somewhat flattened on the inner surface. Imagining the kernel to lie on a flat surface, the vertical diameter was called the thickness, the shorter horizontal diameter the width, and the long diameter the length. The averages of 50 measurements were: — *thickness*: — maximum 2.74 mm., minimum 2.16 mm., average 2.46 mm.; *width*: — maximum 3.71 mm., minimum 2.95 mm., average 3.33 mm.; *length*: — maximum 4.57 mm., minimum 3.07 mm., average 3.90 mm.; *weight of 1000 kernels* 23.5 gm., — *Average volume of 1 kernel*, 16.78 mm<sup>3</sup>. The grain is composed of 6.1 % by weight of bran, 10 % of germ, 83.9 % of endosperm, 35 % of which is starchy, the rest horny. The endosperm is surrounded by a very friable, more or less granular layer, very rich in colouring matter, and soluble in ether and chloroform; it contains no tannin. The distribution of various components of the different parts of the grain, expressed in percentages of the total quantity of each component (the germ, bran and endosperm respectively) in the whole grain is as follows: —

Ash, 77.9, 7.2, 14.9; ether extract, 75.2, 9.9, 14.9; crude protein, (N × 6.25), 15.5, 2.3, 82.2; crude fibre, 19.1, 49.7, 31.2; nitrogen-free extract, 4.1, 5.5, 90.4.

The corresponding parts of kafir and maize kernels resemble each other in composition and appearance; it may, therefore, be assumed that kafir could be used as a substitute for maize.

965 - **Two New Vegetable Globulins: — Stizolobin and the Globulin of Buckwheat.**

— I. JOHNS, C. O. and FENKS, A. J. (Bureau of Chemistry, U. S. Department of Agriculture), Stizolobin, the Globulin of the Chinese Velvet Bean, *Stizolobium nivicum*, in *The Journal of Biological Chemistry*, Vol. XXXIV, No. 2, pp. 429-438 + 13 Tables + Bibliography of 4 Publications. — II. JOHNS, C. O. and CHERNOFF, L. K., The Globulin of Buckwheat, *Fagopyrum esculentum*, *Ibid.*, pp. 439-445 + 6 Tables. Baltimore, May, 1918.

Chinese Velvet Beans (*Stizolobium nivicum*) are being grown in ever increasing quantities in the United States, and, in 1917, covered an area of more than five million acres in the South, an increase of over 100 % of the area cultivated the preceding year. They are used especially as a cattle food, and contain 26.43 % of protein (N × 6.25). By extraction with a sodium chloride solution, and separation by dialysis or precipitation with ammonium sulphate, the authors obtained a globulin which they called

(1) See also *R.*, April, 1918, No. 444. (Ed.)

"stizolobin". The amino-acid content of this globulin determined by VAN SLYKE's method was:—Cystine, 1.20; arginine, 6.72; histidine, 2.65; lysine, 8.27. The lysine content is very high. Stizolobin also contains tryptophane. Analyses of various samples of this globulin by the method mentioned above gave the following percentages:— Carbon, 53.03%; hydrogen, 7.05; nitrogen, 16.33; sulphur, 0.56; oxygen (by difference), 22.94%.

II. — By the method already described (extraction with a solution of sodium chloride, etc.) the authors isolated from buckwheat flour (*Fagopyrum esculentum*) a globulin containing basic amino-acids in the proportions given below according to VAN SLYKE's method:— Arginine, 12.97%; histidine, 0.59%; lysine, 7.90%; cystine, 1.00%. Like stizolobin this globulin is remarkable for its high lysine content, and also contains tryptophane. Several analyses gave the following average percentages for the various constituents of the globulin:— Carbon, 51.69; hydrogen, 6.90; nitrogen, 17.44; sulphur, 1.16; oxygen (by difference), 22.81.

956 - **The High Calcium Content of Some Cucurbitaceous Vines.** — WILKINS, I. K., in *New Jersey Agricultural Experiment Station Bulletin* 310, pp. 20 + Bibliography of 50 Publications. New Brunswick, N. J., April 16, 1917.

In this bulletin data are presented concerning the calcium content of the vines and fruits of some of the cucurbitaceae: namely, pumpkins, preserving citrons, squashes, cucumbers, and cantaloupes. The percentages of N,  $P_2O_5$ ,  $K_2O$ , and  $MgO$  for these cucurbitaceae are also recorded. Furthermore, the crop yields and the removal of plant-food on an acre basis are reported.

The vines were found to have a very high content of calcium, higher than has usually been reported or was believed to exist in most plants. In nearly every instance the mature vines contained calcium at the rate of over 5% of  $CaO$ , rising to as much as 8.75% in one instance.

The amount of calcium in the vines varied at different stages of growth. The tendency was towards an increasing percentage from the early to the later stages of development. In no instance was it less than 3% of  $CaO$  at the first stage taken, nor did it often fall below 6% at the last stage.

The calcium content of the cucurbitaceous fruits was low. In fact, in no instance did it reach as high as 1%. The seeds of the fruits were still lower in calcium, averaging less than 0.25% of  $CaO$ .

In a comparison with the content of N,  $P_2O_5$ ,  $K_2O$ , and  $MgO$ , the percentage of  $CaO$  was almost invariably higher than that of any of these materials in the case of the vines. With the fruits the  $CaO$  percentage was in every instance lower than the percentage of N and  $K_2O$ , and frequently lower than  $P_2O_5$ , but usually higher than the  $MgO$  percentage.

The fact of an increase, as the plants approach maturity, of the  $CaO$  content in the vines attended by a low percentage of  $CaO$  in the fruits, when associated with the fact of a decrease, as the plants approach maturity, of the N,  $P_2O_5$ , and  $K_2O$  content in the vines attended by a relatively high percentage of the same in the fruits, would suggest that a relation

exists between calcium and one or all of these substances in the life processes of the above cucurbitaceae.

On an acre basis the weight in pounds of the CaO content of the vines was found to be much greater, as a rule, than that of the N,  $P_2O_5$ ,  $K_2O$ , or MgO content. The largest amount of CaO was 165.95 lb. in the case of the Yellow Crookneck squash. The largest quantity of any of the other substances was 70.93 lb. for  $K_2O$ , likewise for the Yellow Crookneck squash.

With the fruits the weight in pounds on an acre basis, showed the CaO content to be low — exhibiting a tendency toward the reverse of the results obtained with the vines. The largest amount of CaO was 10.06 lb. for the preserving citron fruits. The highest for the other substances was 62.17 lb. of  $K_2O$  for the cantaloupes.

Taking the entire crops, vines and fruits together, on an acre basis, the content in pounds was found in the majority of cases to be greater for the CaO than for any one of the other substances N,  $P_2O_5$ ,  $K_2O$ , or MgO.

967 - **Inulin in the Sunflower-Jerusalem Artichoke Graft** (1). — COLIN, H. and TROUARD ROLLE, Y., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLVI, No. 21, pp. 856-858. Paris, May 27, 1918.

By grafting reciprocally Jerusalem artichoke (*Helianthus tuberosus*) and sunflower (*H. annuus*) and then analysing the stems above and below the incision, it was found that at whatever level the scion is inserted in the stem and whether the graft be sunflower on Jerusalem artichoke or Jerusalem artichoke on sunflower, there is always, on both sides of the incision, a discontinuity in the polarimetric sign of the soluble carbohydrates in the scion and the stock. The resulting rotatory power is always positive in the sunflower and negative in the Jerusalem artichoke. Inulin is never found in the sunflower. It would, therefore, seem that:—

1) The inulin of the Jerusalem artichoke never enters the sunflower used as stock, or, at least, is very rapidly transformed;

2) Jerusalem artichoke on which is grafted a sunflower scion still forms inulin, not only in the tubers, but throughout the stem, at the expense of the dextrorotary sugars which it derives from the scion.

968 - **Reactions of the Phosphorus of the Thickened Root of the Flat Turnip.** — HARTWELL, B. L., HAMMET, F. S. and WESSELS, P. H. (Agricultural Experiment Station of the Rhode Island State College), in the *Journal of Agricultural Research*, Vol. XI, No. 8, pp. 353-370, Bibliography of 11 Publications. Washington, D. C., November 19, 1917.

In earlier publications of the Rhode Island Agricultural Experiment Station (*Bulletin* 154; 18th *Annual Report* 1904-1905, pp. 253-285) it was shown that the percentage of total phosphorus in flat-turnip roots (*Brassica rapa*) grown in different soils generally varied in the same direction as the variation in the amount of phosphorus which was available to the plant.

In this paper is recorded the work undertaken with the object of ascer-

(1) See R., April, 1918, No. 390. (Ed.)

taining whether the amount of any portion of the phosphorus of the turnip root is correlated more nearly than the total phosphorus with the relative amount available in soils.

Preliminary indications were derived from the successive extraction of dried turnips with ether, alcohol, and 0.2 per cent hydrochloric acid; but, since it was next found that larger amounts of phosphorus could be extracted from fresh than from dried turnips, all subsequent observations were made on fresh turnips.

Coincident with the introduction of phosphorus into a nutrient solution in which turnips were growing, the appearance of "inorganic" phosphorus and the disappearance of starch were traced microscopically in the different tissues; whereas upon withholding phosphorus the disappearance of inorganic phosphorus and the appearance of starch were similarly observed. About four-fifths of the total phosphorus of fresh turnips was extracted with water. When the latter was acidulated, somewhat less was secured because of partial precipitation.

Only a small per cent of the extracted phosphorus failed to pass through dialyzers. Different precipitants of inorganic phosphorus were tested as to their ability to recover phosphate added in a standard solution to the dialyzates. The phosphorus in the precipitate formed by adding acetic acid to turnip juice was not in phospho-protein compounds. There was no phytin in the juice. The presence of a phosphatase was not shown.

Although the proportion of inorganic to total phosphorus in turnips was frequently made larger by phosphatic applications to the soil in which they were grown, this was not always shown to be the case by such methods as were used.

In most instances the phosphorus in the juice was so largely inorganic and constituted so large a proportion of the total that the determination of the latter seemed about as useful as of any portion for furnishing indications regarding the relative amount of soil phosphorus at the disposal of the turnip.

969 — **Injurious Action of Magnesium Carbonate on Plants.** — COUPIN, H., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CI, XVI, No. 24, pp. 1006-1008. Paris, June 17, 1918.

On account of its insolubility in water, magnesium carbonate, so common in the soil, is generally considered incapable of any injurious action on plants, and, consequently, of having any influence on the life of plants and on their geographical distribution. Nevertheless, this salt dissolves in small quantities in water containing carbonic acid, as occurs near roots which give off carbonic gas during respiration. In order to investigate the effect of the carbonate thus dissolved the author carried out various germination tests, some in fresh water, some in the same water containing an excess of magnesium carbonate. After a few days in the same environment — darkness and a constant temperature of 24°C — the results were compared.

Apart from a few exceptional cases (e. g. that of stone pine) magnesium carbonate was decidedly injurious to plants but in a manner and to a degree

which varied according to the species. This noxiousness manifested itself: — 1) by decreased length of the main root; 2) by a considerable reduction of the number and size of the rootlets; 3) by black or brown colour of the roots and rootlets; 4) by reduction of the absorbent hairs (where, as is rather exceptional, they form in an aqueous environment); 5) by shorter aerial parts (except in the case of common cress). In no case did magnesium carbonate appear to have any useful effect, at least under the conditions of the experiment.

70 — **Absorption of Nutrients as Affected by the Number of Roots Supplied with the Nutrient.** — GILB, P. L. and CARRERO, J. O. (Porto Rico Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. IX, No. 3, pp. 73-95 + 22 Tables + 2 Figs., + Bibliography of 13 Publications. Washington, D. C., April 16, 1917.

In the course of several investigations on the mineral nutrition of rice (*Oryza sativa*) it became necessary to know whether the plant could absorb an optimum amount of the mineral element which was supplied to only part of the roots if all the other essential elements were supplied to all the roots. At first thought it would seem that the plant could absorb sufficient of the element supplied to only part of its roots if sufficient selection could be exercised in the absorption of the different nutrients by individual roots. So far as known, no quantitative study has been made of this point; and the tests reported in the article under review were carried out for this reason. The present work does not deal with the effect of the medium on selective absorption by roots, but with the effect of localization of the supply.

The absorption of nitrogen by rice and maize and of phosphorus, potassium, and iron by rice was tested in water cultures, one-half the roots being maintained in a nutrient solution lacking one of these elements. Tests were also made, varying the portion of roots in the complete and incomplete solutions.

The results show that, under the conditions described, the plant does not absorb a maximum amount of the element, and the fewer the roots supplied with the element, the smaller the total amount absorbed. This applies when the total amount of the element supplied is equal to or in excess of the needs of the plant. A curve was plotted showing approximately what portion of the maximum absorption can be expected with any fraction of the roots supplied with the element. With nitrogen and phosphorus the total amount absorbed by plants with half their roots in the complete solution was 0.76 of that absorbed by plants with all their roots in the complete solution. The similar figure for potassium or iron was 0.66. Increasing the concentration of the element in question in the complete solution did not appreciably alter the results.

The amount of the element absorbed per gram of roots increased greatly as the number of roots in the complete solution was diminished. The results are explained on the basis of the rate of utilisation and transference of the elements in the plant. Attention is called to the bearing of these results on the method of applying fertilisers. The results obtained agree with MITSCHERLICH's formulation of the law of minimum.

- 971 - **The Formation of Nitrites from Nitrates in Aqueous Solution by the Action of Sunlight, and the Assimilation of the Nitrites by Green Leaves in Sunlight.** - MOORE, B., in the *Proceedings of the Royal Society, Biological Sciences, Series B*, Vol. 96, No. B'627, pp. 158-167 + Bibliography of 8 Publications. London, June 1, 1921.

The thermo-chemical studies of FAURE, THOMSEN and BERTHELOT have shown that the reactions during the formation of different oxides of nitrogen are endothermic. This is also true of the reaction during the formation of nitrites from nitrates, which can only occur by the transformation of other forms of energy (such as that of light) into chemical energy. The author's studies showed that dilute solutions of nitrates exposed either to the sun or to rays from a source of light rich in light-energy of short wavelength, are transformed into nitrites. This is a case of endothermic photochemical reaction similar to that concerned in the synthesis of starch in the presence of chlorophyll and sunlight. If a layer of glass is interposed between the source of light and the solution of nitrates, transformation is greatly retarded. This shows that the most active rays are those of short length (ultra-violet). When green leaves are immersed in a solution of nitrates comparatively little nitrite accumulates, the green leaves having the capacity in the sunlight of rapidly absorbing the nitrites thus formed. The author concludes that the nitrates of the soil assimilated by the plant are transformed into nitrites in the presence of sunlight, and that the last phases of the synthesis of nitrogenous compounds take place within the green leaf under the action of this light.

The presence of nitrites and nitrates in atmospheric air cannot be attributed, as many workers have thought, to the action of electrical discharges during storms, because it has never been possible to find any real relation between the nitrate and nitrite concentration of atmospheric air and rainwater on one hand, and frequency of storms on the other. The author observed that freshly-collected rainwater contained as much nitrite (about 0.5 part per million) as rain caught during a thunderstorm. ILDSVÅG showed that dew also contains nitrites. The formation of nitrates and nitrites must, therefore, depend on a more constant and evenly distributed factor, such as sunlight, rather than on fortuitous electrical discharges. Rainwater collected for a considerable time contains no nitrites as they have all been oxidised to nitrates, but if it is exposed to strong sunlight or ultraviolet rays nitrites are again obtained.

The nitrites of rainwater and dew are one of the principal sources of nitrogen for plants when the soil has not been enriched with nitrogenous fertilisers. The author, therefore, points out the great importance of the action of sunlight in supplying these compounds so essential to the formation of organic matter.

- 972 - **Choice of Material for Isolating Inflorescences in Selection Work.** - FRUWITZ C., in *Zeitschrift für Pflanzenzücht*, Vol. V, Pt. 4, pp. 391-395. Berlin, 1917.

The nature of the covers used to isolate the inflorescences is not without influence on the fructification because a certain amount of light may be necessary for the normal development of the seed, especially at



the beginning of setting, as was observed by SCHOLZ for the poppy and LUBIMENKO for the pea and wheat.

The author made similar observations for: — *Triticum sativum* (winter and spring wheats); *Hordeum distichon erectum* and *H. distichon nudans*, *Pisum arvense* and *P. sativum*, *Phaseolus vulgaris*, *Papaver somniferum*, *Arrhenatherum elatius*. During his investigations he used covers of various strength, from parchment bags, which allow the light to pass fairly well, to small wooden boxes lined with black paper used for wrapping up photographic plates. In this last case no seed formed while with the less stiff and opaque covers the number of seeds formed decreased. On the other hand, the amount of light absolutely necessary is not the same for all plants, but varies from one species to another, as is shown by the Table: —

	Black paper bag		Parchment bag		No cover	
	Number of inflorescences	Number of seed formed	Number of inflorescences	Number of seed formed	Number of inflorescences	Number of seed formed
<i>Pisum arvense</i>	5 flower.	0	5 flowers	8	5 flower.	14
Barley No 1 Imperial	5 ears	55	5 ears	94	5 ears	112
Wheat 104 Cricwener	5	88	5	129	5	196

The covers used to isolate inflorescences must, therefore, be fairly transparent as the absence of seeds formed is often attributable to insufficient light rather than phenomena of self-sterility.

973 — **The Selection of Barley in Algeria.** — NICOLAS, G., in *Travaux du Laboratoire de Botanique de l'Université d'Alger*, pp. 1-29 + 5 Plates. Algiers, 1918.

In 1911 the author began a series of experiments with the intention of improving barley in Algeria. He dealt with:— 1) the importation of foreign varieties with well known, stable characters and already selected; 2) reciprocal crosses between Algerian barley, or between Algerian and exotic barleys, in order to fix in a single type any desirable parental characters while eliminating any undesirable ones. Unfortunately the war has interrupted the work, which was already considerably advanced, as will be seen from this article.

**SELECTION OF NATIVE BARLEY.** — In order to ascertain the degree of purity of the samples (100 ears), the well known *polygons of variation* were worked out, considering the most important characters. In this way may be chosen the *density* or *compactness* of the ears, using the formula  $D = 10 \frac{a}{l}$ , where  $l$  is the length of the rachis in centimetres,  $a$  the number of grains in 2-rowed barley and  $\frac{\text{number of grains}}{3}$  in 6-rowed barleys.

Thus in an ear of 2-rowed barley having 52 grains and a rachis 13 cm. long, the compactness will be  $\frac{52 \times 10}{13} = 40$ . If, for 100 ears of a given variety, the following series of values is found:—

Compactness . . . . .	30	31	32	<b>33</b>	34	35	36	37
Corresponding number of ears .	0	9	22	<b>34</b>	21	11	3	0

the average compactness of this variety is 33. If these values are represented graphically, taking those for compactness as abscissae and those for the corresponding number of ears (frequency) as ordinates, the *polygon of variation* is obtained, the summit of which is unique in this case and corresponds to the compactness 33. The existence of a single summit shows that the material has a high degree of purity.

If, on the contrary, the following values are found :—

Compactness . . . . .	28	<b>29</b>	30	<b>31</b>	32	33	<b>34</b>	35
Corresponding number of ears .	5	<b>15</b>	12	<b>25</b>	20	8	<b>12</b>	3

the polygon has 3 distinct summits, an evident sign that the barley under question is a very impure mixture of different varieties.

With the help of this method of analysis, the author has examined a very large number of samples from various localities in Algeria, and he has studied their behaviour during the period 1911-14. He thus found that most Algerian barleys are heterogenous mixtures of various forms, from which valuable material could be obtained by selection.

Only 2 barleys, No. 13 and No. 20, remained pure during the whole period of the experiments. The first came from Mechtas, near Boghni, at an altitude of 1594 ft.; the author has selected two initial varieties —  $\delta$  and  $\beta$  — from it; the latter (*Hordeus hexastichon pollidum*  $\beta$ ) remained pure up to 1914, as is shown by the values :—

Compactness . . . . .	26	27	28	<b>29</b>	30	31	32	33	34
Corresponding number of ears .	3	10	18	<b>28</b>	20	12	5	3	1

IMPORTATION OF FOREIGN BARLEYS.— The Swedish (Svalöf) varieties Svanhals, Primus, Hannchen, Chevalier and Prinzess have been tested. The last one gave the best results, especially in fresh clay soils. Thus, at Adéla, it produced 13.54 cwt. per acre from 1911-13. The only defect noticed is a slight degeneration in the quality of the grain; whilst Prinzess barley gives 79.18% of dry extract in Sweden and central France, at Adéla (according to M. PERRI, Director of the School of Brewing at Nancy) the content falls to 72.69 %, but always remaining 2 % higher than that of the native Algerian barleys.

CONCLUSIONS. — 1) The native Algerian barleys represent a mixture of various forms, so that individual selection cannot fail to give positive results.

2) The exotic varieties selected can be introduced into Algeria with the possibility of success, as is shown by the results obtained with Prinzess barley, produced and selected in Sweden, under very different conditions to those in Algeria.

3) The author proposes to extend and continue his work by making a series of crosses; the use of acclimatised foreign varieties and of native types will provide excellent material for the progressive improvement of a cereal so important to Algeria and the surrounding districts.

- 974 - **Selection of Rice in the Philippines.** — I. CUTIERREZ, M. E., in *The Philippine Agriculturist and Forester*, Vol. VI, No. 5-6, pp. 135-152 + 3 Figs. Los Baños, January-February, 1918. — II. GOCO, A. A., *Ibid.* pp. 154-167.

The recent work by JACOBSON on rice and by MENDIOLA on maize may be said to be the only contributions to selection work in the Philippines where the many forms and the lack of uniformity in the types of the cultivated plants offer the breeder abundant material and the possibility of obtaining good results simply by individual selection without the more complicated work of hybridisation. The authors' attempts to improve the native rices by individual selection have met with such success that great hopes are entertained for the future.

I. — **LOWLAND RICES.** — Four Ilocano or bearded rices were studied, namely, 5 893 Ganad, 5 894 Iray, 5 895 Binalayan and 5 896 Dequet a Bolilising, as well as two Tagalog or smooth varieties, 5 892 Binangbang and 5 891 Binicol. Shortly before harvest about 100 samples of each variety were collected, and the seeds of each plant sown separately in rows which numbered 177. In a series of tables are given the analytical results obtained for the descendants — grain yield, quality of grain, number and length of culms, duration of the vegetative period, degree of uniformity. With few exceptions the grain yield of the selected varieties was much superior to that of the original varieties, there being a difference of as much as 100 % in some cases. There was a tendency to correlation between the productivity, degree of uniformity of the lines and tillering.

In rice, which is essentially self-fertilising, natural hybridation is rare, so that it is interesting to note some cases in which this phenomenon occurred. During his selection work the author found a plant, 5892-0808 Binangbang with seed of varying red colour. The plant was a heterozygote, as was shown by an examination of  $F_1$  (13 plants with white seed, 5 with light red, and 12 with red seed), derived probably from a natural cross between two varieties of Binangbang rice, one with white seed and one with red seed.

II. — **UPLAND RICE.** — The varieties selected were Kinandang Pula, Pinursigue, Inintiw, Kinamaleg, Kinagaykay, Guluyang Pula. The results obtained were: — 1) with simple mass selection the yield was raised from 20.20 cwt. of paddy per acre to 23.62 cwt., even without fertilisers; 2) the descendants of the parents of the same variety differ greatly in productivity, tillering, length of culms, etc., thus allowing individual selection to be carried out successfully; 3) by selecting No. 22 of the Pinursigue variety a yield of 51.32 cwt. of paddy per acre was obtained.

- 975 - **Apparent Mutations of Colour in the Beetroot Due to the Effect of Vicinity, in Sweden.** — BIRGER, K. (Seed Selection Station of Weibullsholm, Landskrona, Sweden), in the *Zeitschrift für Pflanzenzüchtung*, Vol. V, Part 4, pp. 357-372. Berlin, 1917.

The multiple variations of colour and form repeatedly observed in beets of the same pure line have not yet been satisfactorily explained. According to the author's latest researches these phenomena are simply due to the effect of vicinity for: — 1) the beet has a high degree of auto-

sterility; 2) its pollen may easily be carried by the wind or insects over as much as 600 yards; 3) the gauze, muslin and other tissues used to isolate the inflorescences are not sufficiently close-textured to prevent the passage of wind-borne pollen. Cross-pollinisation may thus occur in spite of ordinary precautions and thus produce forms and characters that appear quite new, especially as regards the colour of the root.

The colour is due to 2 pairs of factors:  $Yy$  and  $Rr$ .  $Y$  produces yellow, and, together with  $R$ , produces red. White is produced when  $R$  is alone, and also by the simultaneous absence of  $Y$  and  $R$ . Below are shown the results of crossing types each having one of the two factors  $Y$  and  $R$  as homozygotes.

$\text{Parents (P)}$	$YY rr$ (yellow) $\times$ $yy RR$ (white).
$F_1$ generation	$Yy Rr$ (red)
$F_2$	$F_3$
1 $YY RR$ (red)	Constantly red.
2 $YY RR$ (red)	Dividing into 3 reds: 1 yellow.
1 $YY rr$ (yellow)	Constantly yellow.
2 $Yy RR$ (red)	Dividing into 3 reds: 1 white.
4 $Yy Rr$ (red)	Dividing into 9 reds: 3 yellows: 4 whites (as in $F_3$ ).
2 $Yy rr$ (yellow)	Dividing into 3 yellows: 1 white.
1 $yy RR$ (white)	Constantly white.
2 $yy Rr$ (white)	Constantly white.
1 $yy rr$ (white)	Constantly white.
or 9 red: 3 yellow: 4 whites	

On using these gametic formulae to examine the results of one of the many hybridisations studied by the author, it will be seen that many of the chromatic aberrations and variations observed in a pure line can be explained as phenomena due to proximity of the plants.

Thus, for example, the cross No. 8: — Yellow Intermediate ♀ ( $YY rr$ , yellow)  $\times$  Rote Eckendorfer ♂ ( $YY RR$ , red) gave an  $F_1$  with 13 individuals having a red root and an  $F_2$  with 365 individuals having a red root and 154 with a yellow root, in the ratio 3:1, corresponding to the theoretical values of 389.25 and 129.75. In the  $F_3$  the progeny of the red-rooted individuals should also be red-rooted, or at any rate with red and yellow roots in the ratio 3:1 (see the above scheme). This is what actually happens, save for Nos. 3605 and 3606, which give an  $F_2$  for the former of 9 reds: 3 yellows: 4 whites and for the latter 3 reds: 1 white. It seems that these two numbers are new crosses produced spontaneously in the  $F_1$  of the cross No. 8.

The white-rooted individuals of the  $F_2$  should produce, in the  $F_3$ , exclusively white progeny; on the contrary, in many cases red-rooted types appear; these beets should be considered as due to proximity of the plants.

Among the plants of No. 385 of the  $F_4$ , the author chose 45 with

white roots and planted them in a special plot; at the right moment 15 of them were isolated in the usual way; the other 30 were left to flower in the open air. The results obtained in the  $F_3$  are quite convincing: — out of 360 descendants of plants isolated under hoods, only 4, or 1.1 %, had red roots, owing to the small amount of foreign pollen that had penetrated through the hoods. On the other hand, out of 5458 descendants of the uncovered plants, 314, or 5.75 %, had a red or yellow colour. Three groups can thus be distinguished: — 1) with red variations only; 2) with red and yellow variations in almost equal amounts; 3) with yellow variations only.

The 45 white-rooted plants isolated by the author were on the experiment field of the Weibullsholm Station, at a distance of some 600 yards from a plot of the yellow *Ovoïdes des Barres* beets. If the pollen of the latter variety, could, in spite of the distance and other obstacles, arrive to the beets planted at Weibullsholm, it would be easy to explain the phenomena noted in the  $F_3$  by the aid of the following scheme:

*Mother plant*: —  $yy\ RR$  (white).

*Progeny*: — 25 %  $yy\ RR$  (white); 50 %  $yy\ Rr$  (white); 25 %  $yy\ rr$  (white).

*Ovoïdes des Barres*: —  $YY\ rr$  (yellow).

*Possible combinations between the Progeny and Ovoïdes des Barres*: —

- 1)  $yR\ \text{♀} \times Yr\ \text{♂} = Yy\ Rr$  (red).
- 2)  $\left. \begin{array}{l} yR\ \text{♀} \times Yr\ \text{♂} = Yy\ Rr \text{ (red).} \\ yr\ \text{♀} \times Yr\ \text{♂} = Yy\ rr \text{ (yellow).} \end{array} \right\} \text{ in equal parts.}$
- 3)  $yr\ \text{♀} \times Yr\ \text{♂} = Yy\ rr$  (yellow).

In this case there were 6 descendants with red variants, 10 with red or yellow variants, 3 with yellow variants, and the values found are sufficiently close to those calculated.

976 — **A Further Note on the Genetics of *Fragaria*.** — RICHARDSON, C. W., in the *Journal of Genetics*, Vol. VII, No. 3, pp. 167-170. London, May, 1918.

In continuation of previous work on the genetics of *Fragaria* (*Journal of Genetics*, Vol. III, No. 3, Feb. 1914), the author gives further results he has obtained with regard to flower colour, double flowers, hairiness of stems and leaves, and sex.

**FLOWER COLOUR.** — As stated in the previous paper (1), the cross pink flowering *vesca*  $\times$  white flowering *vesca* produced pink flowering  $F_1$ 's. These selfed produced 20 pink, 57 pale pink, 10 white or very nearly white (of the latter at least 3 were absolutely white). Thus the ratio found of 15:1 corresponds well to that calculated: — 81.57 pink to 5.43 white. The excess of white flowers may be due to the difficulty in distinguishing between very light pinks and pure whites.

**DOUBLE FLOWERING.** — The cross double flowering *vesca*  $\times$  single produced in the  $F_1$  single flowers with occasional extra petals. In the  $F_2$  there were 60 single to 24 double flowers, 37 single to 13 double, or a to-

(1) Summarised in *R.*, June, 1914, No. 513.

tal of 97 single to 37 double flowers. This gives the ratio 3:1, corresponding to the expectation 100.5 single and 33.5 double flowers.

The cross single flowered  $\times$  double flowered produced single in the  $F_1$ . The  $F_1$  generation selfed produced 58 single and 25 double giving a ratio of 3:1 corresponding to the expectation 62.25 single to 20.75 double.

**HAIRY LEAF STEMS AND FRONT OF LEAF.** — The factor "hairy" is dominant as regards the factor "glabrous". In a cross *F. Virginiana*  $\times$  *F. Chilensis* the  $F_1$ 's had "hairy" stems and the front of the leaves was hairy. The  $F_1$ 's selfed produced 32 "hairy" to 10 not "hairy"; 32 leaves were "hairy" and 10 glabrous; with a ratio of 3 to 1 in each case.

**SEX.** — The results of the various crosses are given in the following table.

Crosses			Distribution of sexes in $F_1$	
			Females	Males or hermaphrodites
<i>F. chinensis</i>	$\text{♀} \times \text{♂}$	<i>F. chilensis</i>	26	21
<i>F. chinensis</i>	$\text{♀} \times \text{♀}$	<i>F. Virginiana</i>	18	14
<i>F. Virginiana</i>	$\text{♀} \times \text{♀}$	<i>F. mexicana</i>	20	15
<i>F. Virginiana</i>	$\text{♀} \times \text{♀}$	<i>F. Virginiana</i>	17	16

The total obtained was 183 females to 155 males or hermaphrodites. There is thus a dominance of the female, which seems to fit a 9:7 ratio. The difficulty here is the classification, as an apparently male plant (e g., a *F. Virginiana*) may sometimes set a fruit or seed. This is why the author finds it simpler to group all sterile flowers with the sex to which they appear to belong, and to consider males and hermaphrodites as one sex.

977 — **Wheat, Yields per Acre and Prices, by States, for the 50 Years 1866-1915 in the United States.** — U. S. Department of Agriculture, Bulletin No. 511, 16 pp. of tables. Washington, February 13, 1917.

The year 1915 completed the first 50 years during which the United States Department of Agriculture has collected annual data on the yield and value of the most important crops in the different States of the Union. The bulletin under review gives the annual figures for wheat from 1866 to 1915. The tables referring to the different States are preceded by general figures for the production in the whole of the United States and six divisions of the country; — 1) *North Atlantic*, including the States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey and Pennsylvania — 2) *North Central, East*: Ohio, Indiana, Illinois, Michigan and Wisconsin — 3) *North Central, West*: Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas — 4) *South Atlantic*: Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida — 5) *South Central*: Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Texas.

Oklahoma and Arkansas — 6) *Far West*: Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Idaho, Washington, Oregon, and California.

The 10 year averages of wheat yields in bushels per acre for the whole Union and for these 6 divisions respectively were:

	United States	North Atlantic	North Central, East	North Central, West	South Atlantic	South Central	Far-West
1866-1875 . . . . .	11.9	13.7	12.2	13.5	8.1	8.5	15.7
1876-1885 . . . . .	12.3	14.1	13.9	12.0	8.9	8.0	14.1
1886-1895 . . . . .	12.7	14.2	13.8	12.4	8.8	9.6	14.2
1896-1905 . . . . .	13.5	16.2	13.4	13.1	10.8	11.6	17.3
1906-1915 . . . . .	15.0	18.1	16.3	13.0	13.0	12.4	22.4

978 — **Cultivation of Manitoba Wheat in Touraine, France** (1). — SCHREIBAU, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 17, pp. 528-530. Paris, May 15, 1918.

The author gives the following conclusions deduced from an investigation made by M. MARTIN (Director of the Agricultural Department of Indre-et-Loire):—In the least successful experiments Manitoba wheat gave 7 to 11.92 cwt. per acre. Everywhere else the yield varied from 9.54 to 16.72 cwt.; the average might without exaggeration be placed at 11.14 cwt. per acre. These figures are all the more remarkable because the average yield of winter wheat is 8.34 cwt. There is no doubt that 1917 was a very favourable year for wheat growing in that district; May and June were wet and there was no excessive heat in July. In spite of all disadvantages M. MARTIN considers Manitoba wheat excellent for Indre-et-Loire. Thanks to this new variety it will be possible to sow wheat in spring which could not be sown in autumn.

The author shows the extent to which Manitoba wheat is penetrating and spreading in countries where it was totally unknown — Piedmont, Greece, etc. Most of the reports received by the author favour its cultivation. The fact that some tests have not given the hoped-for results is due to insufficiently sorted seed. To prevent this farmers should ask for 110 to 120 lb. of Manitoba for every 100 lb. of seed to be sown. This wheat is too small to pass through a sorter; it is sufficient to pass it through a 2 mm. mesh sieve to eliminate foreign, broken, or small and malformed grains and obtain excellent seed. In a good lot the waste will not exceed 10 % and may be used for making flour. Failure often results from using too little seed. As Manitoba tillers little 1.59 cwt. per acre should be the smallest amount used. The actual amount must, however, be determined by the farmer, who must bear in mind that it should be sown more thickly than ordinary varieties, and greater quantities be used the later it is sown.

(1) See also No. 1051 of this Review (Ed.)

979 - **Red Clover and its Varieties, in New South Wales, Australia.** — BREAKWELL, F., in *The Agricultural Gazette of New South Wales*, Vol. XXIX, Pt. 2, pp. 105-109 + 1 Fig. Sydney, February 2, 1918.

There are many strains of red clover (some workers recognise as many as thirty) most of which are named after the regions where they were produced. It is impossible to distinguish any difference in the structure of the various strains except in the character of the stem. Thus, the stem of New Zealand Cow Grass and Perennial Red are solid, whereas those of the American strains, such as Giant Hybrid and Broad Red, are hollow. On the other hand the various strains differ in important cultural characteristics, such as duration (1 to 4 or 5 years) and the amount of foliage produced.

The maintenance of a clover pasture is generally considered to depend on the production of self-sown seed and the setting of seed due to pollination by bumble-bees. These insects do not exist in New South Wales and some years ago an unsuccessful attempt was made to introduce them there. At the Yanco Experiment Farm it was found that of 20 heads of flowers examined, more than 80 % of the flowers had not set seed. In 1917 at the Glen Innes Experiment Farm it was found that a plot of Chilian clover had produced 250 lb. per acre, a very fine crop. Among the insects visiting the plants Italian bees were very plentiful at Glen Innes, butterflies and ants at Yanco. Clover pastures lasting many years are common in New Zealand as a result of harrowing in the seeds dropped from the plants from time to time. This method has been adopted at Glen Innes.

The varieties grown in New South Wales are:— Cow Grass, Perennial Red (the two most largely grown), Giant Hybrid Red, Broad Red, American Red and Chilian Red. The yields are usually good, and at Glen Innes very high ones have been obtained. Chilian Red Clover was first introduced by the Hawkesbury Agricultural College; in the experiments at Hawkesbury and Glen Innes, Yanco, Grafton and Bathurst Experiment Farms as well as in those made by farmers, it always surpassed all the other varieties previously tested. Its principal characteristics are:— permanence, resistance to drought and frost and heavy yield (at Glen Innes in 1916, 4 tons 5 cwt. of hay per acre). The New South Wales Department of Agriculture is undertaking the supply of acclimatised Chilian clover seed, among which there are practically no hard seeds, difficult to germinate. The vitality of the seed in seven days was over 90 %.

980 - ***Enneapogon mollis* in Ascension Island.** — STAFF, O., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 217-219 + 1 Photograph London, 1917.

In Ascension Island, formed of barren volcanic matter, except for one peak with scanty endemic vegetation, a new wild grass, identified at Kew as *Enneapogon mollis* Lhm (= *Pappophorum molle* Kunth.) appeared unexpectedly in 1917. This plant transformed stretches of previously desert land along the coast and in the plains (it also grows in brackish places) into large green meadows. Where the soil is best it grows to a height of 3 feet.

It appears to be an annual and is found particularly in tropical desert



districts such as that described, on the coast of Angola, in Great Namaqualand, from whence it extends through the Kalahari Desert to Bechuanaland and Griqualand. It has also been found in the Sudan, Abyssinia, Eritrea, and Somaliland, Madagascar, and, on one occasion, in the Punjab.

Nothing definite is known of its value as a fodder plant, but there is no doubt that it would be very important as such in all arid countries. As a similar plant is mentioned *Schmidtia bulbosa* Stapf of North Rhodesia, a perennial, very nourishing grass, suited to the same conditions as *Enneapogon mollis*, the cultivation of which in Ascension Island is recommended if it will succeed there.

981 - Experiments on Steppe Pasture in the Dehesa de Nuestra Señora del Pilar, the Central Steppe of Spain. — ESTEVE, F., in the *Revista de Montes*, Year, XLI, Nos. 970 to 976, pp. 423-429, 472-476, 512-515, 559, 585-593, 665-666. Madrid, June to September, 1917.

The Dehesa (pasture land) de Nuestra Señora del Pilar, at Caracena del Valle (municipality of Castillejo del Romeral, province of Cuenca), at an altitude of from 2 624 to 3 608 feet, is an estate of 4 940 acres,  $\frac{2}{3}$  of which are wood and pasture land. Whereas this estate could previously feed a fairly large number of cattle, at the time the author began to improve it could barely support 1 000 sheep, which had to be given fodder during a great part of the year. According to the author the gradual deterioration of pasture land occurs as a general rule in Spain, and is due to the fact that nothing is done to renew it, so that the pasture grass gradually gives place to weeds, which the animals refuse. The result is that, though a century ago Spanish stock breeding occupied one of the first places in the world, Spanish pasture-land today can with difficulty support 27 lb. of live weight per acre as compared with 450 lb. in some countries where intensive cultivation is practised. While the author was improving the estate in question Dr. E. REYES' important work, *Las estepas de España y su vegetación*, was published. This work decided the author to extend his research and to investigate the problem of the improvement of mountain pasture-land in Spain. The investigations include:— 1) Pure seeds, i. e., the use of commercial seed belonging to a single botanical species under various conditions, with a study of the habit of growth and the quality and quantity of the product, the age at which the plant begins to produce and that in which it is producing fully, its economic duration, acclimatisation, etc.; 2) Experiments in improvement by cultivating forage crops on the central steppe; 3) Experiments with different seed mixtures; 4) re-planting and cultivation of the mountain pasture-land of Nuestra Señora del Pilar; 5) a study of the bushes and trees growing on these pastures, and the acclimatisation of these plants. A table shows the numerous species used as pure seed, giving for each one:— the agricultural value (product of *purity* by the *germinating capacity*, expressed in per cent); the amount of seed required per acre; whether the species in question does or does not belong exclusively to the flora of the steppes. The basis of the various mixtures of forage seed used

were; 1) dry-land alfalfa; 2) sainfoin; 3) clover. For example, in 1916, a dry year in which the seeds were very late, two cuttings of Group 2, gave the following yields of green forage per acre: — mixture of 85 % of sainfoin (*Onobrychis sativa* var. *bijera*) + 15 % of tall oat grass (*Arrhenatherum elatior*) 11.15 cwt. of forage; mixture of 45 % of sainfoin + 55 % of great burnet (*Poterium Sanguisorba*), 66.90 cwt.; mixture of 70 % of sainfoin + 30 % upright brome grass (*Bromus erectus*), 49.38 cwt. For each seed the author determined the percentage of the "supplement" or amount of extra seed to be used for the mixture as compared with the amount required for pure seed.

Judging by the vegetation of the various plots, alfalfa does best with cocksfoot (*Dactylis glomerata*). With this grass wild alfalfa (*Medicago sativa* var. *sylvestris*) produces more than when sown with great burnet. Mixtures with a basis of Provence alfalfa gave more forage than those of wild alfalfa. Sainfoin and great burnet do well together, especially for pasture land. The mixture sainfoin + tall oat-grass produces yet more, and the mixture sainfoin + brome grass is good in poor, dry soils. Of the mixtures with a basis of clover those with red clover (*Trifolium pratense*) gave the best results; those with a basis of white clover (*T. repens*) also did well, but those with a basis of Swedish clover (*T. hybridum*) did not give good results. Timothy (*Phleum pratense*) was the grass which did best with red clover.

On a plot prepared for irrigation various species were grown in lines 8  $\frac{1}{2}$  inches apart for the production of seed. These are only harvested every two years, and in 1916 some of the species were cut. They gave the following yields in green forage per acre: — cocksfoot, 45.16 cwt.; brome grass, 44.60 cwt.; tall oat grass, white clover, bird's foot trefoil, 44.60 cwt. each; serradella (*Ornithopus sativus*), scorpion senna (*Coronilla scorpioides*) and crown vetch (*C. varia*) 31.86 cwt. each.

The list of forage plants belonging exclusively to the steppe flora which have been found at Castillejo include: 13 Gramineae, 10 Leguminosae, 1 Liliaceae, 1 Rosaceae, 1 Umbelliferae, 1 Gentianaceae, 1 Convolvulaceae.

982 — **The Time at Which Cotton Uses the Most Moisture.** — McCLELLAND, C. K. (Georgia Agricultural Experiment Station), in the *Journal of the American Society of Agronomy*, Vol. X, No. 4, pp. 185-186. Washington, April, 1918.

It is known that cotton requires less water than a crop of maize or oats, indeed, drought during the period of filling and ripening of the seeds causes a notable reduction in the yield of these cereals, whereas drought during the period of the ripening (opening) of cotton bolls is beneficial. The ripening period of grain, however, corresponds to the blooming (filling) period of the bolls, and drought at this period causes a large number of the cotton buds to drop.

By experiments made in 1915 and 1916 at the Georgia Experiment Station the author determined by means of potometer cultures the amount of water required by cotton during its growth. In each of the 11 weeks (from the 1st week of July to the 3rd week of September) in 1915, 10 plants grown in potometers consumed the following quantities of water respectively

(in litres):—19.4, 77.1, 169.7, 193.7, 285.0, 232.8, 271.9, 293.0, 112.5, 263.0, 150.2. In each of the 10 weeks between that ending July 25 to that ending October 7, 1916, 11 cotton plants in potometers consumed the following number of litres of water respectively:—24.75, 103.50, 157.50, 128.25, 139.50, 85.50, 49.00, 27.00, 85.50, 49.50. From the 1st to the 7th of these weeks the number of flowers opening on the 11 plants was:—0, 33, 44, 105, 85, 74, 42. There appears, therefore, to be a correlation between the period of the highest rate of flower-opening and that during which the plants consume the most water. If this be so, it would be advisable to cultivate the soil sufficiently late for it to conserve its moisture during the summer months, *i. e.*, a little later than is usually done in the United States.

983 - **Zapupe** (1). — *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 239-240. London, 1917.

Zapupe fibre first came into prominence a little more than 10 years ago. In 1907, in the State of Vera Cruz, there were over 5 million plants in various stages of growth. The following three cultivated species have been identified by TRELEASE: — *Agave zapupe* Trel. (local names:—blue zapupe, zapupe azul, zapupe de Estopier, zapupe de San Bernardo of Tuxpan, Vera Cruz); *A. Lespinassei* Trel. (local names:—zapupe de Tepezintla, zapupe de Vincent of Juana, Ramirez and Tuxpan); *A. Deveyana* Trel. (local names:—cultivated green zapupe, zapupe de Huasteca, zapupe de Panoyuca, zapupe verde of the region between Tampico and Vera Cruz). None of these species are known in the wild state, but TRELEASE distinguishes a fourth, *A. aboriginum* (2), known in the district between Tampico and Vera Cruz as wild zapupe, zapupe cimarrón, zapupe silvestre, zapupe de Sierra Chontla; this is said to be cultivated sometimes. In the *Diplomatic and Consular Reports* (No. 4453, p. 5, Tampico; Washington, 1910) it was stated that in 1909 the planting and cultivation of zapupe continued to attract much attention and that several 3-year old plantations were cleaning and exporting fibre. In 1910, besides the planting done by private individuals, many companies had formed for the cultivation of zapupe (*Ibid.* No. 4665, p. 9, Vera Cruz; Washington, 1911). In 1911 a Belgian syndicate made arrangements for developing this fibre plant in the Vera Cruz district (*Ibid.*, No. 4873, p. 9, 1912). In 1913 it was reported that its cultivation had ceased, and that no fibre had been exported that year (*Ibid.*, No. 5365, p. 15, Tuxpan, Vera Cruz; 1914). A sample of zapupe fibre (species indefinite) from Mexico was valued in 1913 at £ 30 to £ 32 per ton; in the same year sisal fibre realised up to £ 35 per ton. In countries where the conditions are suited to *Agave* cultivation it is best to grow sisal hemp, which is better known and, which notwithstanding previous statements, is apparently not inferior to zapupe.

984 - **The Mulberry as a Textile-Fibre Plant.** — See No. 1040 of this Review.

(1) See *R.* 1911, No. 1/44; 1913, No. 938. (*Ed.*) — (2) Five species are described by TRELEASE (*Transactions of the Academy of Sciences, St. Louis*, Vol. XXVIII, 1909), the four mentioned above and *A. Endlichiana schottica*. (*Ed.*)

985 — "Sélé", "Cocorico" and *Ximenia americana*, African Oil-Yielding Plants — PIERAERTS, J., in the *Annales du Musée Colonial de Marseille*, Year XXV, Ser. 3, Vol. IV, (1916), Pt. 2, pp. 1-21. Marseilles-Paris, 1917.

Of the three seeds examined by the author, the first two came from the Belgian Congo and the third from British Africa.

I. SÉLÉ. — The plant known locally by this name appears to be popular among the natives in certain parts of the Belgian Congo. The author examined a specimen from Mowbasa (Bengala district) prepared locally by:— 1) roasting the seed, decortication and winnowing; 2) disintegration of the kernel by pounding; 3) separation of the oil by boiling water; 4) removal of the supernatant oil and clarification by standing and filtration.

The tests made by the author led him to conclude that sélé is essentially composed of a mixture of glycerides of oleic, linoleic, stearic, palmitic and lauric acids. It also contains a small quantity of an acid of a higher molecular weight, which could not be identified owing to the lack of a sufficiently large sample of raw material.

Sélé oil is an excellent edible oil, with an agreeable, sweet flavour, which, if carefully prepared by modern methods, would not have the burnt taste of the sample examined. Its value is increased by its good keeping qualities. It is without any doubt suitable for soap-making, and its relatively high glycerine content should make it much sought after by manufacturers of this product. It is useless for the manufacture of stearin products as its solid acid content is too low. It may be considered as a semi-siccative oil to be classed with cottonseed oil.

II. COCORICO. — This plant is a variety of *Citrullus vulgaris*. Cucurbitaceae with seeds containing fats are widely distributed in many parts of the Belgian Congo. The increasing cultivation of them from year to year is not only due to their easy adaptation to the quality of the soil, but especially to the fact that they need no cultural care. These Cucurbitaceae indeed grow so rapidly and vigorously that they prevent the invasion of weeds. In his paper on native agriculture in the eastern province of the Belgian Congo, THARIN (1) states that, in 1914, there were about 500 acres of oil-yielding Cucurbitaceae among the plantations along the Lokandu-Schuka road alone.

It should be noted that in the Belgian Congo the term "cocorico" has no very precise botanical signification. In the Upper Ituri it is applied to the seeds of a variety of gourd or melon called "maboke" or "n'du" in the Kilendu language, whereas in the eastern province a distinct variety of maboke which ripens more slowly and is said to contain less oil is known as cocorico.

The oil examined by the author was prepared on April 25, 1914 at Yangambi (Stanleyville district) by a method called "arabisée", which is in reality only a variation of the method already described for sélé oil. The only difference appears to be that in the "arabisée" method decortication precedes roasting.

A chemical analysis showed cocorico oil to be a valuable product with

(1) *Bulletin agricole du Congo belge*, Vol. VI, 1915, p. 147.

all the desirable qualities of sélé oil. Cocorico seed contains 37.50 % of oil which, in ratio to the kernel, is 50.46 % of the dry matter content. The cake is rich in nitrogen and would make an excellent nitrogenous fertiliser. So long as it contains no injurious or toxic substances (which is very improbable) cocorico-seed cake would be a valuable food for cattle or poultry, especially if mixed with starch or sugar. The tegument of cocorico seeds contains an appreciable amount of nitrogen and would make excellent composts.

In spite of the unquestionable value of its oil nothing at present indicates that cocorico might form an important export even if modern extraction methods are used and a higher yield obtained. The author considers the low unit yield of cocorico and the difficult and slow decortication of its seed make it useless for commercial purposes. On the other hand the home trade in cocorico oil and that of similar Cucurbitaceae should be encouraged in the Belgian Congo both locally and between the different districts.

III. *Ximenia americana*. — This bush belongs to the Oleaceae family and is usually found in the tropical districts of the old and the new continent. It is particularly abundant in America and the west coast of Africa. Dr. E. HECKEL (1) described in detail the botanical variations of this plant as well as its food value and toxic properties.

The *Ximenia* is known by many local names peculiar to the different countries in which it is found. In Jamaica it is called "mountain plum" or "sea plum", in Gabon, "elozy", "zégéné", or "sea lemon". In South Africa, whence the sample studied by the author came, it is called "zuur pruim" (acid plum).

The value of the "sea plum" lies particularly in the high oil content of its seed. In all probability the plant will be largely used commercially as soon as it is better known and cultivated more carefully and intensively.

Among the new properties found in it the author draws particular attention to the hexabromide test and the special properties of the solid acids. According to its percentage of bromine derivatives insoluble in ether, *Ximenia* should come immediately after linseed and candle-nut oil in the list of siccative oils, with respect to the linoleic acid content.

The oil extracted from this plant is used by the South African natives to make candles and to anoint their bodies. The fruit is said to make excellent preserves.

186 - *Elaeis Polissonii*, a New Species of Oil Palm, in the Cameroons. — FACCÈRE, in the *Bulletin de l'Office Colonial*, Year XI, Nos. 121-122, pp. 80-83. Melun, January-February, 1918.

In a paper sent to the author (Inspector of Agriculture, Secretary of the Council of Colonial Agriculture of the Acclimatisation Society) M. E. ANNET reports the occurrence in the Cameroons of a variety of oil palm, the commercial value of which appears to be very great. M. ANNET has made a new species of this form of *Elaeis* and has dedicated it to

(1) HECKEL, Les graines nouvelles ou peu connues des colonies françaises, Paris, 1898, p. 27. (Author)

EUGENE POISSON, one of the first to study oil palms in Dahomey and who, towards 1903, did much to further the commercial utilisation of the palm. The new species has, therefore, been called *Elaeis Poissonii*. It is remarkable for its fruit which is enclosed in a sort of fleshy sheath formed by the development of six staminodes contained in the female flower which, in the other varieties of *Elaeis* hitherto described, are always atrophied. The fruit, which is generally fairly large, weighs from 10 to 20 gm.

M. ANNET distinguishes two varieties — var. *tenera* and var. *dura*. A comparison of these two varieties with each other and with the var. *Lisombe* of *Elaeis nigrescens* (the best form of oil palm known at present) gave the following figures with respect to the different parts of the fruit and the yield in oil :—

	<i>Tenera</i>	<i>Dura</i>	<i>Lisombe</i>
Oily Pulp . . . . .	76 %	44 %	61.5 %
Sheath . . . . .	37	18	
Pericarp . . . . .	39	26	
Nuts . . . . .	24 "	56 "	38.5 "
Shell . . . . .	13	42.6	27.5
Kernel . . . . .	11	9.8	17
	100	100	100
Oil yield of the pulp . . . . .	70.25 %	58.6 %	63.15 %
" " of the whole fruit . . . .	53.50	55.8	38.35

These figures show that it would be of great value to cultivate the *tenera* variety. M. ANNET obtained the following figures for ten fruits of each of the chief varieties of *Elaeis* in the Cameroons :—

	Weight in grams			
	of the fruit	of the pulp	of the kernel	of the oil
Dibope . . . . .	123.0	51.5	23.0	27
Lisombe . . . . .	121.5	76.5	20.5	47
Dura . . . . .	171.0	74.2	18.1	44
Tenera . . . . .	168.5	128.3	19.4	90

987 - The Oil Content, Keeping Qualities and Commercial Possibilities of Para Rubber Seed.—SPRING, F. C. and DAY, F. W. F., in *The Agricultural Bulletin of the Federal Malay States*, Vol. VI, No. 5, pp. 231-244. Kuala Lumpur, February, 1918.

This paper gives a report of the experiments carried out by the Department of Agriculture of the Federated Malay States and reproduces data previously obtained by the Imperial Institute (1).

A few years ago there were wide areas of land suitable for growing *Hevea*. There was, therefore, a large demand for the seeds, which realised good prices. Now, however, as many of the plantations have come to maturity the production has increased enormously and the demand has greatly decreased, so that the problem of using the seed for other purposes arises. The average production in the Malay Peninsula may be estimated at 306

(1) See R. 1913, No. 1362 and R. 1914, No. 240. (Ed.).

lbs. per acre. In a seven-hour day one child, paid 18 cents a day can collect about 5 000 seeds; 1 000 seeds dried in the sun to constant weight weigh 8 lb. 6 oz., of which the shells weigh 3 lb. 2 oz. and the kernels 5 lb. 4 oz.

To test the keeping properties of the whole seed and the husked seed, samples were placed in gunny sacks and in wooden boxes as follows:—

A) *Whole seeds*. — 1) put in sacks the day after being collected; 2) put in boxes the day after being collected; 3) packed in sacks after having been sun-dried for three weeks.

B) *Husked seeds*. — a) shelled after being dried in the sun for 16 days:— 4) put in sacks; 5) put in boxes; b) shelled the day after being collected:— 6) packed in sacks.

The samples of Group 1 were in excellent condition after 4 months and good after having been stored for 6 months. Those of Group 2 varied; one began to deteriorate after 3 weeks, and others were slightly mouldy after 2 ½ months or 4 months; another was in good condition after 6 months. The samples of Group 3 were in excellent condition after 4 months' storing. Those of Group 4 were in good condition after 2 ½ months; one sample was slightly mouldy after 4 months, another had kept well but was infested with insects after 6 months. The seeds of Group 5 were in good condition after 6 months, but those of Group 6 began to deteriorate at the end of 3 weeks and were decayed after 4 months.

Crushing the whole seed of three samples in good condition and extracting with petroleum ether gave:— 51.8 to 53.3 % of oil by weight in the kernel; 23.5 to 31.4 % in the whole seed; 8 to 23 % of acidity (mgm. of KOH per gm. of oil); a sample of decayed seed gave slightly different results — 46.2, 23.2, 34 %. (In all these determinations the limit of accuracy is within 0.5 % only). *Hevea brasiliensis* seeds can, therefore, keep for a fairly long time. The oil yield and composition of good and decayed seeds differ little.

The dried husks contain 0.70 % and the dried kernels 1.83 % of ash, containing respectively 37.8 and 44.8 % of matter soluble in water; 7.9 and 18.6 % of magnesia; 38.6 and 37.2 % of potash; 16.8 and 28.6 % of phosphoric acid. The nitrogen and protein contents are:— 0.22 and 1.39 % for the shells, and 2.45 and 15.3 % for the kernels, respectively. The last figure corresponds to 27.8 % of protein residue in the cake after 45 % of oil has been extracted.

988 - **The Effects of Tapping and Wintering on the Food Reserves of *Hevea*.** —

RUTGERS, A. A. L., in *Mededeelingen van het Algemeen Proefstation der A. V. R. O. S., Rubberserie*, No. 1, pp. 1-7 + 3 Plates. Batavia, 1917.

The author studied the effects of tapping and wintering on the food reserves of *Hevea* in order to solve the following points:— 1) Does not the system of tapping used at present remove a larger quantity of food reserve than the tree is able to store up? 2) During wintering does not the plant draw upon these reserves to such an extent that, in order not to exhaust them, it would be better to stop tapping?

The conclusions of other workers (1) (CAMPBELL and BATESON) on this subject agree. They state that the effects of tapping on the food reserves of the wood and bark are exceedingly slight and limited to the immediate neighbourhood of the incision. On the other hand, the effects of wintering are more serious. The amount of reserve food contained in the wood and bark remains normal till the new leaves begin to develop. About a fortnight later, when the leaves have reached the normal size, the starch in the bark and wood has disappeared to a depth of 5 to 10 mm. For this reason these workers consider tapping should be stopped during the growth of the leaves till one week after the development of the tree's foliage is complete.

The author does not consider this opinion to be well-founded. He calculates the disappearance of the starch in the bark and wood to a depth of 10 mm. to represent a decrease of about  $\frac{1}{6}$  of the total reserve food of the plant, leaving  $\frac{5}{6}$  of this reserve available. Four or six weeks after the development of the leaves the reserves will again be totally replaced. Seeing that tapping only removes very small quantities of starch within a limited radius round the incision, the author does not consider there is any serious physiological reason for stopping tapping during wintering.

989 - Value of the Results Obtained by the Use of Apparatus for Estimating the Rubber in Latex. — RUTGERS, A. A. L. and MAAS, J. G. J. A., in *Mededeelingen van het Algemeen Proefstation der A. V. R. O. S., Rubber Serie*, No. 3, pp. 1-24 + 20 Tables. Batavia, 1917.

The authors wished to test the value of the results obtained with certain patented apparatus at present in use for the estimation of rubber in latex, such as DRING and FAGE's "Metrolac" (2), and GRIFFIN's "Latexometre". Many workers (UITÉE, GORTER, etc.) agree as to the small value of determinations obtained thus. The many tables given by the authors and compiled from four series of estimations made with different apparatus by different people confirm this opinion. The results which were in each case checked by weighing the dry samples, showed a deviation between the *actual* values obtained by weighing and by the apparatus, but an agreement in the *relative* values. The use of the apparatus is, therefore, justified in so far as it gives relative and comparative data. The deviations in the absolute values are probably due to faults in setting up the apparatus and to the influence of temperature. As a matter of fact the values found do increase as the temperature rises.

990 - Bibliography of the Publications on Rubber Which Have Appeared Between 1910 and 1916. — RUTGERS, A. A. L., in *Mededeelingen van het Algemeen Proefstation der A. V. R. O. S., Rubber-serie* No. 5, pp. 84. Batavia, 1917.

The author considers the publications previous to 1910 especially of historical interest, or of interest only to specialists, and therefore refers only to the work of R. MARZAHN: — "*Wissenschaftliche Arbeiten über Kautschuk, Gutta-percha und Balata*" (published in the *Gummi-Zeitung*, Years I to XXV, Berlin, 1886 to 1910). He also leaves aside all publications of an

(1) See R. 1915, No. 814 and 917. — (2) See R. 1917, No. 1207. (Ed.)



economic or financial character, dealing with commerce, planter's societies, etc. The bibliography under review, therefore, is of interest solely to planters and those who prepare the product, and is drawn up eminently for practical purposes. It is divided into six chapters:— 1) General cultural methods; 2) Preparation, coagulation, vulcanisation; 3) Pathology; 4) Cultivation in various countries — Java, Sumatra, other Malay countries, Ceylon, Brazil; 5) Reports, conferences, miscellaneous; 6) Periodicals.

991 — **Measurement of the Growth of Sugar Cane; Observations Made in the Dutch East Indies.** — KOPPER, J. (Inspecteur der Cultuuraafdeeling te Pasoeroean), in the *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year XXVI, No. 5, pp. 163-165 + 6 Tables + 25 Diagrams. Soerabaja, January, 1918.

To measure the growth in height of sugar cane the author uses a specially constructed apparatus consisting of a high, square, wooden rule graduated in centimetres fitted with a slider to which is attached a small copper plate graduated in millimetres.

The numerous measurements made by the author and given in the form of diagrams, show that the time between the appearance of two successive shoots varies between 5 and 7 days for the local varieties observed. Night growth usually exceeds day growth, but the latter is much influenced by rain, which may cause a day growth superior or equal to night growth. The moisture content of the air has practically no influence, or only very rarely has any perceptible effect.

992 — **Analysis of "Cocoa Tea", a New Substitute Used in Great Britain.** — BAKER, J. L., and HULSON, H. F. E., in *The Analyst*, Vol. XLIII, No. 507, pp. 189-197 + 4 Tables. London, June, 1918.

The present war conditions have stimulated research for substitutes of all kinds. One of the most recent which it has been attempted to introduce into Great Britain is a beverage made from cacao shell which remains after the seed has been roasted. This substitute is known as "cocoa-shell tea".

The data published on this residue and the attempts made to utilise it are rapidly reviewed. They show that beverages made from this material are not very highly valued, nevertheless these shells have recently been put on the market at prices out of all proportion to their food value, which has been exaggerated. The authors consider this matter should be remedied, and that the use of cacao shells cannot be objected to so long as they are sold at a reasonable price in conformity with their food value. The results of the analysis of several samples are given in the tables; the average figures are:— Moisture 4.68 %, fat 3.56 %, total ash 10.52 %, nitrogen 2.42 %, crude protein ( $N \times 6.25$ ) 2.42 %, crude fibre 15.42 %, matter soluble in cold water 21.0 %. The content in matter soluble in hot water was also estimated to determine the practical value of the substitute. A mixture was made by boiling 3 parts of cacao shell with 100 parts of water and then straining. The figures obtained were higher than those for the content in matter soluble in cold water. This was partly due to the fact that a certain quantity of matter in suspension passed through the strainer.

- 993 - **Trials with Réunion Tobacco in Mauritius, in 1916-1917** — AUCHINCLOSS, G. G., in the *Department of Agriculture, Mauritius, General Series, Bulletin* No. 9, pp. 12. Port Louis, 1917.

In Mauritius there is a large importation and consumption of Réunion tobacco (chiefly used for strong cigarette tobacco). Owing to this, cultivation tests of this variety have been started in the Pamplemousses Botanic Gardens and in two other localities in the island, on a total area of about  $3\frac{1}{4}$  acres. The results were completely satisfactory; from 195 992 sq.ft. 535 carottes of 11 kg. each were obtained. No verdict can as yet be given as to the quality of the tobacco, as the special preparation necessary requires from 18 to 24 months.

The Réunion tobacco called "tabac bleu" is notable for its uniform foliage and growth (probably resulting from prolonged selection) and, so it appears, a greater resistance to diseases and pests than that of the Virginian, Sumatra and Turkish tobaccos so far tested at Pamplemousses.

- 994 - **Medicinal Plants of the Italian Colonies.** — *L'Agricoltura coloniale*, Year XII, 1st Half Year, No. 1, pp. 54-56. Florence, March 21, 1918.

Towards the end of January, 1918, the MOLteni chemical-pharmaceutical company asked the *Agricoltura coloniale* for a list of the medicinal plants of the Italian colonies in order that the pharmaceutical produce to be obtained from them might be studied. The *Agricoltura coloniale* immediately wrote to the agricultural departments of Tripoli, Bengasi, Asmara and Mogadiscio asking for information on the native plants of the colonies which might best be cultivated for medicinal purposes. The Royal Agricultural Department of Tripoli sent the following list:—

1) Plants already widely grown in Libia or the cultivation of which could be introduced or increased:—

*Cupressus sempervirens*, *Mirabilis Jalapa*, *Lepidium sativum*, *Papaver somniferum*, *Nigella sativa*, *Rosa* sp., *Acacia Farnesiana*, *Poinciana Gilliesii*, *Trigonella Foeniculum-gracum*, *Punica Granatum*, *Lawsonia alba* (the measures adopted by the government to suppress adulteration have given good results), *Coriandrum sativum*, *Cuminum Cyminum*, *Zizyphus Spina-Christi*, *Ricinus communis*, *Nerium Oleander*, *Hyoscyamus* sp.

It would probably be possible to grow successfully:—

*Glycyrrhiza glabra* and *Myrtus communis* in Cyrene; *Cassia obovata*, *Sinapis nigra* and *Datura Stramonium* in Tripoli.

2) Wild plants of the coastal districts which by reason of the present political situation can be harvested and utilised:—

*Juniperus phoenicea* (Cyrene), *Asphodelus microcarpus*, *A. pendulinus*, *Urginea maritima*, *Cynomorium coccineum*, *Atriplex Halimus*, *A. mollis*, *Polygonum equisetiforme*, *Papaver Rhæas*, *Adonis microcarpus*, *Thapsia garganica* (Cyrene), *Peganum Harmala*, *Malva sylvestris*, *Calotropis procera*, *Solanum villosum*, *Withania somnifera*, *Ajuga Iva*, *Citrullus Colocynthis*, *Diotis maritima*, *Matricaria aurea*.

3) Useful wild plants which, on account of the present political situation, cannot be harvested:—

*Callitris quadrivalvis*, *Cornulaca monacantha*, *Athagi maurorum*, *Balanites ægyptiaca*, *Halophyllum vermiculare*, \**Thymus capitatus*, *Globularia Alyssum*, *Artemisia Herba-alba*.

995 - **Pine-Apple Growing in the Azores.** — ILOZ, T., in *Broteria*, Pt. 3, pp. 123-127 + 2 Figs. Braga, 1918.

As the climate of the Azores does not permit the growing of pine-apples in the open they have been grown in greenhouses since the beginning of the 19th century in the islands of San Miguel and Terceira. In the second island exportation has practically ceased since the last thirty years or so, and the few pine-apple greenhouses left are used almost exclusively for local requirements. In the island of San Miguel, on the other hand, there are about 3 000 greenhouses which supply a large export trade.

The San Miguel greenhouses are double, about 165 feet long and 34 feet wide, and are built of wood and iron, covered with glass. An aisle leads up the centre, separating two beds raised slightly above the level of the soil. Propagation is by cuttings after the fruit has been gathered and the leaves removed. When the surface layer of soil has been removed a layer of clean dry leaves is laid down, over which is thrown another layer of the previous year's soil, in which the cuttings are placed; these are in their turn covered with a layer of new, good quality humus. When the leaves ferment they produce much heat which causes the cuttings to germinate. When the new shoots are four months old they are separated from the cuttings and planted, in squares at intervals of 1 foot in another greenhouse where the beds have been prepared as in the first one. After seven or eight months they are transplanted in the final greenhouse, prepared as the other two, in squares at intervals of 20 to 24 inches. Five months after transplanting fumigation is carried out. Dry straw and bits of plants are burnt in the central aisle and for three days the greenhouse remains full of the smoke produced. One month after this fumigation the plants flower all together and the fruit ripens at the same time, thus leaving the house free immediately after the harvest. Two years elapse from propagation to the harvest — five months in the nursery, seven in the first hothouse, and twelve in the second. During the period of fructification the temperature must be kept at 25 to 30°C. In summer the houses are ventilated to prevent excessive temperatures. Plantation and harvesting may be done at any time of the year. The most common varieties are "Jamaica" and "Cayenne".

The fruit to be exported is carefully packed in pine-wood cases with double-bottoms through which the peduncle is passed. Each case contains from 1 to 6 or 8 fruits.

During 1903-1916 the annual export from San Miguel was from 1 to 1½ million of fruits (in round figures) with a value of from 300 000 to 450 000 milreis (£ 66 500 to £ 100 000 at par). Before the war the principal importing countries, in decreasing order of importance, were:— United Kingdom, Germany, United States, France, Italy.

996 - **Overhead Irrigation of Strawberries in Illinois, U. S. A.** (1). — See No. 1032 of this Review.

997 - **The Douglas Fir: Its Importation and Cultivation in Central Europe** (2). — BERKHOUT, A. H., in *Mededeelingen van de Landbouwhooischool en van de daaraan verbonden Instituten*, Vol. XIV, Pt. 1, 2 and 3, pp. 47-56 + 5 Tables. Wageningen (Holland), 1918.

The American tree commonly known as the Douglas fir was discovered in North America in 1792 by the explorer ARCHIBALD MENZIES and imported into Europe by DAVID DOUGLAS in 1827. The Douglas fir has many names in America — red fir, black fir, hemlock, swan pine, etc. The confusion of botanical names is no less great and is due to the fact that botanists disagree as to the genus to which it belongs; they call it *Abies Douglasii* Lindley, *Pinus Douglasii* Sab., *Pinus taxifolia* Lamb; *Picea Douglasii* Link, *Tsuga* or *Pseudotsuga Douglasii* Carr. There are many varieties of Douglas fir — blue, green, blueish-green (*glauca*), etc.; the last of these has smaller cones and is of slower growth. Douglas fir is one of the most widespread trees in America and is found particularly in the Rocky Mountains, Sierra Nevada, Colorado, and British Columbia. Its geographical distribution is between 43 and 52° north latitude. A well-aerated, very light soil containing a certain proportion of sand and stones, suits it best. It can stand a damp atmosphere better than excessive drought and should be sheltered from continuous winds. In the State of Washington it does very well up to 1150 feet, and in Oregon up to 1800 feet; above this altitude its growth is more restricted. According to MAYR Douglas fir is very resistant to frost in its native country, indeed, it grows in districts where the temperature is sometimes below -25°C. If its importation into Europe has not always given the expected results this is due to the fact that care has not always been taken to use seed from a district in which the environmental conditions are similar to those of the district in which plantations are to be made. It has also been shown that the poor sandy soil, as well as the marsh soil or excessively clayey soil of central Europe, do not suit it. The young plants may also be attacked by a fungus — *Botrytis Douglasii* — and by a canker — *Pestalozzia funera* Desm.

The rapid growth and excellent quality wood of the Douglas fir make it one of the most profitable trees for silviculturists. Data collected by HANZLICK on several plantations show this tree to have attained the following average weights and diameters (in the middle): — in 20 years, 29.83 feet and 0.35 feet; in 40 years, 76.32 feet and 0.69 feet; in 60 years, 101.25 and 1.01 feet; in 100 years, 125.55 feet and 1.34 feet. This fir may reach a height of 330 feet and a diameter of 16.40 feet. On the damp west coast of North America it generally attains in 80 years a height of 130 feet and a diameter of 2.62 feet. Of two neighbouring plantations at the Experiment Station of Wageningen one of these plantations of 18 years had an average height of 38.15 feet and an average diameter of 0.45 feet. The

(1) See R., March and April, 1912, Nos. 486 and 627; R., December, No. 1090; R. Jan. and Dec., 1915, Nos. 95 and 1330; R., May and August, 1917, Nos. 408 and 708. (Ed.)

(2) See also R., Jan. and Feb., 1915, Nos. 61 and 194. (Ed.)

data show that this tree had a diameter of 0.49 feet at Wageningen *five years earlier than in its native country*. Growth is not less rapid in other parts of Europe. In Germany (Oldenburg), a 37-year old plantation had an average height of 59.04 to 65.60 feet and an average diameter of 1.95 feet. Similar figures were obtained in England.

The wood of Douglas fir is solid and very resinous and used for many purposes, such as building wood, props and supports for mines and ship-yards. As timber and wood for commercial purposes it polishes very well and is used for cabinet work, and for making parquet and wainscotting. In Germany, the wood of a 25-year old tree had a specific weight of 0.536 and a resistance to pressure of 443 to 531 kg. per sq. cm.

The author foresees more numerous plantations of this tree in all central Europe, especially in places sheltered from strong winds and in clearings. The necessity of the choice of seed suited to the district, *i. e.*, from a country where the climatic conditions are as similar as possible, is emphasized. In Holland such seed-control is assured by the "Nederlandsche Heide-Maatschappij" (Dutch Association for the Development of Land).

998 - **The Utilisation of the Dead Leaves of Forests.** — See No. 1042 of this Review.

### LIVE STOCK AND BREEDING.

999 - **Purifying Water for Stock.** — *Queensland Agricultural Journal*, Vol. VIII, Pt. 4, p. 209. Brisbane, October, 1917.

Water containing mud in suspension is easily clarified by dropping hot wood ashes into it, or by the application of lime or alum. These two substances make the water hard. Chloride of iron may be also used; it is quite harmless, and a valuable reconstituent and tonic for all animals. One lb. of chloride of iron will clarify 1 000 to 2 500 galls. of water and much reduce the bacterial content.

A simple method of purifying water without boiling has been devised by Dr. NAISMITH and Dr. GRAHAM. The method consists in adding a level teaspoonful of chloride of lime (containing  $\frac{1}{3}$  available chlorine) to a cupful of water. Dissolve, dilute with 3 more cupfuls of water, allow to stand for a few seconds; this stock solution, kept in a tightly stoppered bottle, may be used for 5 days. Add a teaspoonful to 2 galls. of water to be purified; stir well to bring the weak chlorine solution in contact with all the bacteria, and allow to stand for 10 minutes. This will destroy all typhoid and colon bacilli, or other dysentery producing bacilli in the water. The water will be without taste or odour and the trace of free chlorine added rapidly disappears.

1000 - **Cut-throat Grass (*Panicum Combsii*) and Salt Sickness; Investigations in the United States.** — PIPER, C. V. (Office of Forage Crop Investigations, Bureau of Plant Industry, U. S. Department of Agriculture), in the *Journal of the American Society of Agronomy*, Vol. X, No. 4, pp. 162-164. [Washington, March 20, 1918.

Cut-throat grass (*Panicum Combsii*) has so far been described for Florida, Georgia, and the south of Alabama, Mississippi and Louisiana, as

a rare species found especially on the edges of ponds. The author found it in great abundance in Polk County, central Florida, where it forms most pure growths of tufty bushes with tough, wiry leaves, almost erect, and from 6 to 18 inches long. Breeders in the district use it as a winter forage for fattening adult steers and non-pregnant cows, but believe it causes abortion in pregnant cows and a disease known as "salt sickness" in young animals. This disease which has frequently been studied in Florida is characterised by chronic anaemia, loss of flesh, loss of appetite, thin, pale blood, white mucous membranes, etc. STOCKBRIDGE, FRENCH and ENNIS (*Florida Agricultural Experiment Station Report*, 1900-1901, pp. 43-58, 1902) believe the cause of salt sickness to lie in the food and recommend as remedies alimentary correctives and tonics, as well as a change of pasture as a preventative and curative measure. Lime water, gentian, or iron salts ( $\frac{1}{2}$  oz. air-slacked lime or  $\frac{1}{8}$  oz. of iron sulphate in 3 gallons of water, the first *ad lib.*, the other once a day) have always proved useful. On the other hand C. F. DAWSON (*Florida Agricultural Experiment Station Bulletin* 64, 1902) believes salt sickness to be chronic Texas Fever (piroplasmosis) and that the food eaten is but a secondary cause.

1001 - Gossypol, a Toxic Substance in Cottonseed (1).—WITHERS, W. A. and CARRUTH, F. E., in the *Journal of Agricultural Research*, Vol. XII, No. 2, pp. 83-101 + 10 Tables + 1 Plate + Bibliography of 19 Publications. Washington, January 14, 1918.

Raw cottonseed kernels contain about 0.6% of gossypol and are highly toxic to rats. Ether extraction renders the material non-toxic and gives a highly toxic extract containing about 2% of gossypol. Gossypol fed in milk diets in amounts equivalent to those contained in the raw cottonseed diets proved as toxic as raw cottonseed. Gossypol may be quantitatively removed from the ether extract by precipitation as its insoluble anilin compound ( $C_{30}H_{28}O_6 \cdot 2C_6H_5NH_2$ ). The extract is thus rendered non-toxic to rats. Gossypol prepared from this compound possesses its original toxic properties.

Cottonseed meal is much less toxic than raw cottonseed, owing mainly to the oxidation of gossypol during cooking.

Cottonseed meal, ether-extracted cottonseed, and gossypol were fed to small pigs in pens under comparable conditions. Cottonseed meal was found to be definitely injurious, while the ether-extracted raw seed did not appear to cause cottonseed-meal poisoning. Gossypol was toxic to pigs.

If the presence of an injurious substance in the meal is disregarded, a diet of cottonseed meal and maize meal has nutritive limitations which may, under restricted conditions of living, lead to failure of pigs to thrive. Such failure is a phenomenon distinct from cottonseed-meal poisoning. Outdoor exercise, access to forage and soil, and improved diets tend to postpone or avert cottonseed-meal poisoning of swine. The deficiency hypothesis that cottonseed-meal poisoning of swine is similar to beriberi is untenable.

(1) See also *R.*, Jan. 1918, No. 64 and March, 1918, No. 306. (Ed.)

1002 - **Observations on the Etiology of Epizootic Lymphangitis** (1). — VÉLU, H., in the *Bulletin de la Société de Pathologie exotique*, Vol. XI, No. 5, pp. 351-357. Paris, May 8, 1918.

The author gives an account of his observations on the etiology of epizootic lymphangitis, resulting from work carried out in the research laboratory of the "Service de l'Elevage" at Casablanca.

1) *Contagion*. — Epizootic lymphangitis is transmitted by simple direct or indirect contact; immediate contagion is the rule. Inoculation takes place through the harness or grooming, infected hands of veterinary surgeons or farriers, soiled grooming tools, etc.

Experiments on the part played by flies gave negative results, without proving, however, that they play no part.

2) *Penetration*. — Transmission commonly occurs by means of some skin (harness wound, kick, fracture, injury, war wound, etc.) or mucous (auto-inoculation) erosion. Any break may serve as an entry to the RIVOLTA cryptococcus, which appears to be a saprophyte common in warm, damp climates. In Morocco, where the cryptogamic flora is extremely rich, epizootic lymphangitis is an ordinary complication of all severe wounds or fistulous sores that do not receive regular antiseptic dressings.

With the present state of our knowledge the disease cannot be transmitted with certainty. The positive results obtained by DELAMOTTE and other workers should be accepted with caution, as the exceptionally long period of incubation allowed by them does not exclude the possible intervention of other factors of infection. Other authors, however, have obtained negative results.

As a general rule, the primary lesions in epizootic lymphangitis are dermal or intradermal. The author attempted to ascertain whether inoculation in the dermis would lead to the appearance of the disease. In the more fortunate cases the result was the formation of a single abscess which proceeded towards recovery without the formation of secondary boils. Intravenous injection of large doses of pus were never followed by even the slightest reaction. The insertion of virulent matter into the bone marrow did not give good results. It was even found impossible to cause the formation of specific lesions by auto-inoculation.

BRIDÉ, NÈGRE and TROUETTE have found that hypodermic injections of yeasts cause the formation of abscesses; the organism shows a greater intolerance to each new injection; instead of acquiring immunity against the yeasts it appears to become accustomed to expell them. The author has observed similar phenomena in the case of the cryptococcus during attempts at pyovaccination.

1003 - **Preliminary Report on the Virulence of Certain Body Organs in Rinderpest.** —

BOYNTON, W. H., in *The Philippine Agricultural Review*, Vol. X, No. 4, pp. 410-433. Manila, 1917.

The following results were obtained while endeavouring to devise a

(1) See *R.*, June, 1917, No. 561; *R.* August, 1917, No. 734; *R.* Feb., 1918, Nos. 177 and 178; *R.* March, 1918, Nos. 310 and 311. (*Ed.*)

method of securing the aggressins of rinderpest. Since the virus of rinderpest cannot at present be satisfactorily cultivated under artificial conditions, it was decided to try to extract the virus from the tissues of animals suffering from this disease. From the symptoms, lesions, and microscopical findings, it is quite evident that the virus attacks primarily the involuntary muscles and endothelial lining of the capillary vascular system and the parenchymatous tissue. From the results obtained by the intravenous injection of various drugs and disinfectants it is quite evident that the virus of rinderpest does not have its fountain head of development in the blood stream. The real place where the virus multiplies appears to be inside the tissue cells where the disinfectants can not penetrate, the virus in the blood stream being merely a surplus which is thrown off from these tissue cells. In following this line of reasoning the writer decided to consider certain tissues where lesions were more or less pronounced, as cultures and extracts were made from them. The tissues used by him were liver, spleen, lymph glands, heart, intestines, thymus, skeletal muscle, larynx, pharynx, and the back of the tongue from animals which were either bled to death for virulent blood or from animals which had died after a regular course of the disease.

The tissues were taken from the animal as soon after death as possible. The amount of tissue desired was weighed, ground in a sterilised meat grinder and placed in a sterilised flask where twice as much phenol solution was added. This material was thoroughly agitated two or three times a day and kept in the refrigerator at 15-16°C., or it was agitated continuously for 48 hours at room temperature, then placed in the refrigerator for 24 hours, and then filtered through gauze and the filtrate replaced in the refrigerator until used for injection to caraboes.

The results may be summarised as follows :—

Water extracts of the liver, spleen, and lymph glands 3 days old and a 0.5 % phenol extract of liver, spleen, lymph glands, heart muscle, caecum and colon 5 days old are highly infectious to susceptible animals. On the other hand, the skeletal muscle, the larynx, pharynx and base of tongue and the pancreas are not suitable tissues for making extracts in the case of rinderpest. A 0.5 % phenol extract of liver, spleen and lymph glands holds the virus of rinderpest in a virulent form for periods of time varying from 8 to 55 days. A 1 % phenol extract of liver, spleen, caecum and lymph glands 17 days old are highly infectious and a 1 % phenol extract of liver and spleen 21 days old are virulent to susceptible animals. When glycerin is added to a 2 % phenol extract which had been agitated for 48 hours the virus of rinderpest is readily destroyed. In a 2 % phenol extract of lymph glands 8 days old the virus of rinderpest is destroyed. It is advisable to use a 0.75 % phenol extract not over 15 days old. The tissues best adapted for this work are the liver, spleen, lymph glands, heart, fourth stomach, caecum and colon.

From the results obtained in working with rinderpest it is very plausible that similar or even better results may be obtained with the virus of hog cholera along these lines.



1004 - Observations on the Control of *Rhipicephalus annulatus australis*, in Queensland, Australia. — THOMSON, F., KEOGH, G., and TUCKER, G., in the *Queensland Agricultural Journal*, Vol. VIII, Pt. 6, pp. 302-307. Brisbane, December, 1917.

The Queensland cattle tick (*Rhipicephalus annulatus australis*) lives as a parasite on cattle only. The females, gorged with blood, drop to the ground, where three days later they begin to lay; they continue for 10 to 21 days, each one laying from 1 500 to 3 000 eggs. These hatch during a period of 21 to 42 days. The larvae climb on to leaves, fence posts, and similar objects, where they can live without food for several months. If they find no host they eventually die; if they attach themselves to an animal they pierce the skin and feed on the blood. After 7 days of parasitic life they pupate, and after another 7 days the adults emerge. The adults live on the host for another 7 days; during the last 24 hours the females gorge themselves with blood, then drop to the earth, and the cycle re-commences.

The Department of Agriculture of Queensland recommends the following dip against ticks: — commercial arsenic, 1 700 gm.; caustic soda, 800 gm.; tallow, 800 gm.; vegetable tar, 1 litre; water, 800 litres. The animal must be completely covered by the solution, and should even be made to swim in it. This method has been employed in Queensland for about 20 years with excellent results. There is no doubt that an animal which has been twice dipped at intervals of 8 days is perfectly free from ticks and may be sent into an immune district without danger of its carrying the parasite there.

Of recent years breeders have tended to reduce the concentration of the dip, by reducing the amount of arsenic to 1 400 and even 1 200 gm. per 800 litres of water, and to replace dipping by spraying. A series of experiments made at the Stock Experiment Station at Townsville showed conclusively that: — 1) the official formula must not be diluted; 2) spraying, even if repeated each week for several months is not as efficient as dipping at intervals of one or two weeks; consequently spraying is inefficient as a control.

1005 - Thymic Acid and Thymol in the Treatment and Prevention of Intestinal Coccidiosis in Cattle. — TREMONA, P. (R. Scuola Superiore di Medicina Veterinaria di Torino), in *Il Nuovo Ercofanti*, Year XXIII, No. 10, pp. 113-115. Turin, May 31, 1918.

According to observations of the author, Dr. SANLORENZO and others, intestinal coccidiosis or red scour frequently affects cattle in the marshy regions to the north-west of the province of Venice. In confirmation of the results obtained by Dr. SANLORENZO, the author obtained recovery in 4 to 6 days by administering thymic acid at the rate of 15 gm. for adults and 10 gm. for calves. In order to prevent the disease, he dosed the healthy animals for 3 days with 5 gm. of thymol per head per day.

1006 - Life History of *Ascaris lumbricoides* and Related Forms. — RANSOM, B. H. and FOSTER, W. D. (Zoological Division, Bureau of Animal Industry, U.S. Dept. of Agric.), in the *Journal of Agricultural Research*, Vol. XI, No. 8, pp. 395-398. Washington, D. C., November 19, 1917.

The life history of *Ascaris lumbricoides*, the common intestinal round-

worm of man, and of *A. suum* or *A. suilla*, of very common occurrence in the intestine of pigs, has been recently studied by F. H. STEWART, of the Indian Medical Service. In spite of their different names, these worms are the same parasite, or forms so closely related that they are morphologically indistinguishable. As a result of his investigations STEWART was led to a conclusion contrary to the usually accepted opinion that the infection of man or pig with *Ascaris* results from the ingestion of the eggs of the parasite. He concluded that it is necessary in the life cycle for the eggs to be swallowed by rats or mice and that in these animals the embryos hatching from the eggs undergo certain migrations and developmental changes, after which they may be transferred in the faeces or saliva of the rats or mice to food or other materials likely to be ingested by human beings or pigs, and thus ultimately reach their final hosts. The authors have reviewed and repeated STEWART's experiments, and from the various contributions of other investigators toward the solution of the problem of the life history of *A. lumbricoides* and related parasites, and their own experiences, arrive at the following conclusions:—

The development of *A. lumbricoides* and closely related forms is direct, and no intermediate host is required. The eggs, when swallowed, hatch out in the alimentary tract; the embryos, however, do not at once settle down in the intestine, but migrate to various other organs, including the liver, spleen, and lungs. Within a week, in the case of the pig *Ascaris*, the migrating larvae may be found in the lungs and have meanwhile undergone considerable development and growth. From the lungs the larvae migrate up the trachea into the oesophagus by way of the pharynx, and this migration up the trachea may already become established in pigs, as well as in artificially infected rats and mice, as early as a week after infection. Upon reaching the alimentary tract a second time after their passage through the lungs, the larvae, if in a suitable host, presumably settle down in the intestine and complete their development to maturity; if in an unsuitable host, such as rats and mice, they soon pass out of the body in the faeces.

Heavy invasions of the lungs by the larvae of *Ascaris* produce a serious pneumonia which is frequently fatal in rats and mice and apparently caused the death of a young pig one week after it had been fed with numerous *Ascaris* eggs. It is not improbable that ascarids are frequently responsible for lung troubles in children, pigs, and other young animals. The fact that the larvae invade the lungs as well as other organs beyond the alimentary tract and can cause a serious or even fatal pneumonia indicates that these parasites are endowed with greater capacity for harm than has heretofore been supposed.

Age is a highly important factor in determining susceptibility to infection with *Ascaris*, and susceptibility to infection greatly decreases as the animal becomes older. This, of course, is in harmony with the well-known fact that it is particularly children and young pigs among which infestation with *Ascaris* is common, and that *Ascaris* is relatively of rare occurrence in adult human beings and in old hogs.

1007 — "Askaron", a Toxic Constituent of Intestinal Worms, especially of Ascarids, and its Biological Action. — SHIMAMURA TORAI and FUJII HAJIME, in the *Journal of the College of Agriculture, Imperial University of Tokyo*, Vol. II, No. 4, pp. 189-258 + 4 Figs. — Bibliography of 12 Publications. Tokyo, 1917.

The authors have isolated from the mesenteric liquid of dried and powdered ascarids (*Ascaris lumbricoides* of the pig and *A. megalocephala* of man) an extremely toxic propeptone, for which they propose the name of "askaron". This propeptone produces all the symptoms of poisoning observed in ascariadasis and following on injections of the mesenteric liquid or aqueous extract of ascarids. It is also present in other intestinal worms. The authors have found it present (with the same toxic properties) in *Filaria immitis*, the larvae of *Gastrophilus*, *Sclerostomum vulgare*, *Oxyuris curvula*, *Trichocephalus depressiusculus*.

The ether and alcoholic extracts of dried, powdered ascarids are non-poisonous even in strong doses, but they always have a haemolytic action not possessed by "askaron".

The most sensitive among the experimental animals were found to be horses, then guinea-pigs, dogs and rabbits; rats and mice were refractory. The chief symptoms of "askaron" poisoning are troubled breathing, dilatation of the peripheral blood vessels, increased secretions and excretions, nervous disturbances, depression of the temperature and arterial pressure; on autopsy, are observed:—dilatation of the lungs (in guinea-pigs); hyperaemia and haemorrhagic exudation in the gastro-intestinal canal, in the endocardium and internal organs (particularly the lungs); partial coagulation of the blood. The fatal dose of crude "askaron" per kg. of live weight, given intravenously, is 0.004 mgm. for the horse, 0.8 mgm. for the guinea-pig, 2 mgm. for the dog, and 5 mgm. for the rabbit.

In the horse, the instillation of even very dilute solutions (up to 1 in 10,000) of crude "askaron" always produces a copious lachrymal secretion, which is supposed to be due to the volatile constituents of the "askaron". On repeatedly giving instillations, the reaction becomes weaker and weaker, but never wholly disappears.

After a first poisoning by "askaron", great resistance is quickly developed; the "askaron" obtained from different species is reciprocally immunising and to an equal degree.

"Askaron" is primitively toxic; the normal serum of the horses contains no antibody against "askaron". The horse can be actively immunised against a dose of askaron 400 times the mortal one; this great immunity is probably due to cellular resistance.

"Askaron" should be considered as a metabolic product of the worms.

1008 — I. Morphology of Normal Pigs' Blood. II. Effects of Muscular Exercise and the Heat of the Sun on the Blood and Body Temperature of Normal Pigs. — PALMER, C. C. (Veterinary-Research Laboratories, Minnesota Agricultural Experiment Station), in: I. *Journal of Agricultural Research*, Vol. IX, No. 5, pp. 131-140. Washington, DC., April 30, 1917; II. *Ibid.*, Vol. IX, No. 6, pp. 107-180 + Bibliography of 9 Publications. May 7, 1917.

I. — The work reported in this paper was undertaken with the view

[1007-1008]

of establishing normal data under conditions which exist in Minnesota as a basis for future studies and so corroborate the work of other investigators.

After an historical review of the subject, the author describes his own experiments and summarises the results obtained as follows:—

The number of erythrocytes in the blood of the pig varies under different conditions. It is lower in young animals than in old. It also varies according to the condition of the animal. A well-nourished pig in good condition will show a higher count than a pig in poor condition and of the same age. It was about equal in the blood of male and female animals.

The leucocyte count was lower in young animals, but individuals of the same class may show considerable variation. It seems to be higher in male than in female animals.

The percentage of haemoglobin was higher in older animals; it was higher in male than female animals.

The specific gravity of the blood was higher in older animals.

The clotting time was less in younger animals.

Five classes of leucocytes can be recognised in the blood of the pig:—Lymphocytes, large mononuclears, polymorphonuclears, eosinophiles, and mast cells. Results of the differential counts by various workers are fairly uniform. The percentage of lymphocytes and large mononuclears is higher in young animals. Older animals show a higher percentage of polymorphonuclears, eosinophiles, and mast cells than young animals. Differential counts in male and female animals are about the same.

II. — This work was carried out, in part, along with the preceding one. The author's summary is given below.

1) Blood examinations in normal resting pigs, covering a period of 24 hours, may be quite uniform; but in some animals there is marked variation throughout the period.

2) Observations made upon a number of animals leads to the conclusion that muscular exercise does not cause an increase of red corpuscles in the peripheral circulation of the pig.

3) Results based on only one or a few experiments may lead to wrong conclusions, owing to the variability in the blood of pigs.

4) Evidence given by work with the pig tends to confirm the theory of perspiration being responsible for the increase in the number of red corpuscles following muscular exercise in man.

5) Muscular exercise in the pig is usually followed by a leucocytosis.

6) This leucocytosis is probably the result of muscular exercise forcing leucocytes into the general circulation from the tissues.

7) Muscular exercise leads to marked changes in the differential counts. The mononuclear elements are decreased, and the polymorphonuclear elements are increased. The height of the curve is reached several hours after exercise, and the normal proportions do not return for many hours.

8) Exposure to the sun causes similar changes in the differential curve.

9) These changes under both conditions are the result of increased rate of aging of the leucocytes, the cells becoming older faster than young cells are being produced.

10) Muscular exercise and heat of the sun lead to a marked increase in body temperature.

11) Body temperature changes are more pronounced in fat pigs than lean ones, but even in pigs weighing 75 to 100 pounds marked changes are likely to occur.

12) Increased atmospheric temperature and increased percentage of humidity lead to increased body temperature.

13) Blood examinations of pigs which are to be used for clinical records should be taken from animals which have been confined in a small cool pen for at least 24 hours, and better, 48 hours. The animals must be kept absolutely quiet and not worried. Feeding and watering should be regular. The daily blood examinations should be made at the same time on each day.

14) Temperature records which are to be used for clinical records should be taken from pigs kept in a cool, shady pen. The animals should not be exercised or worried when the temperatures are taken. If the animals are chased around the pen when endeavouring to obtain the temperature, the last temperatures taken may show a marked rise. For tuberculin work where the temperatures are used it would be best to keep them confined in a crate throughout the test.

15) The condition of the animal (amount of fat), the temperature of the atmosphere, and the percentage of humidity are factors which should be considered in determining the normal temperature of the pig.

1009 - **Investigations into the Action of the Thyroid Gland, in the United States.** -

I. ALLEN, B.M., The Results of Thyroid Removal in the Larvae of *Rana pipiens*, in *The Journal of Experimental Zoology*, Vol. XXIV, No. 3, pp. 499-520 + 4 Tables + 8 Figs. + 1 Plate. - II. SWINGLE, W. W., The Acceleration of Metamorphosis in Frog Larvae by Thyroid Feeding and the Effects upon the Alimentary Tract and Sex Glands, *Ibid.*, pp. 521-543 + 1 Table + 14 Figs. + Bibliography of 11 Publications. Philadelphia, January, 1918.

I. - Although numerous investigations have been made into the effects of removing the thyroid gland from young and adult animals, there are no data on the results of removing this gland from animals at a very early stage of their development. Such an operation is exceedingly difficult in the embryonic stages of reptiles and birds, and almost impossible in that of mammals. The author, therefore, used amphibians for this purpose, taking as subjects tadpoles of *Rana pipiens*, of which the metamorphosis offers a very wide field of observation. It was found that the complete removal of the thyroid gland does not affect the course of early development till the hind limbs have begun to grow; further differentiation then ceases and metamorphosis does not occur. The general soma development, that of the limbs, alimentary tract and brain (the anterior portion of the head is of abnormal form, lengthened and broadened) were specially studied. No other organ seemed to show any further differentia-

tion, except the gonads, which were unaffected by the removal of the thyroid gland. This coincides with WEISSMANN's hypothesis of the independence of the germ plasm from the soma. The administration of thyroid extract to these larvae caused a resumption of growth even four months after it has ceased, thus corroborating the results of the following investigations.

II. — Other workers have observed that thyroid feeding greatly hastens the differentiation and metamorphosis of tadpoles. In this manner GUDERNATSCH obtained from frog larvae in a very short time perfect frogs no larger than flies. The author continued these experiments with a special view to the influence on the reproduction organs. Frog larvae were fed a powdered thyroid extract mixed with 30 % its weight of flour. Immediately after the administration of this food the subjects ceased to grow, eight days later limb buds were observed with a hand lens. Pigmentation was rather more marked than in the control animals, and in a very short time the subjects had all the characteristics of adult frogs, with the exception of the gonads and germ cells, the development of which was similar in the experimental and the control animals.

*Results.* — 1) There is no immediate physiological connection between the thyroid gland and the reproduction organs of amphibians.

2) With this exception the administration of thyroid extract to frog larvae has a marked influence on the bodily changes of the animals, all the organs and systems passing rapidly from the larval condition to that of the adult.

**1010 — Effect of Time of Digestion on the Hydrolysis of Casein in the Presence of Starch.**

— McHARGUE, J. S. (Laboratory of Chemical Research, Kentucky Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XII, No. 1, pp. 1-7. Washington, D. C., January 7, 1918.

The Van Slyke method for protein analysis (*Journal of Biological Chemistry*, Vol. X, No. 1, pp. 15-55, 1911) was worked out upon mixtures of relatively pure amino-acids and was not intended to be applied directly to crude sources of protein contained in cereals and feeding stuffs. Notwithstanding this fact, GRINDLEY, SLATER et al., of the Illinois Experiment Station, published in 1915 the results of the determination of the amino-acids contained in cottonseed meal, tankage and alfalfa hay, applying the Van Slyke method directly to the proteins contained in these different feeds. A little later NOLLAU, of the Kentucky Experiment Station, published his results, obtained by the same method, on about 25 different sources of crude protein contained in various seeds and feeding stuffs. In December 1915, GRINDLEY, SLATER et al., published a second paper on the amino-acid content of various feeds, including wheat, oats, barley and soy bean, a number of which had been analysed by NOLLAU. They obtained results which did not agree well with those of NOLLAU. HARTH and BENTLEY, of the Wisconsin Experiment Station, commenting on this lack of agreement have stated that whether accurate determinations of any or all the amino-acids can be secured when the hydrolysing proteins are in contact with hydrolysing carbohydrates must first be ascertained before these data can be accepted as final. HART and SURE have

published results obtained upon the hydrolysis of casein, alone and in presence of a number of different carbohydrates, on a 48-hour digestion and concluded that their work on casein and GORTNER's work on fibrin hydrolysed in the presence of cellulose *definitely* show the inapplicability of direct hydrolysis for the estimation of amino-acids in feeding stuffs by the Van Slyke method. But it occurred to the author that a duplication of the experiment of HART and SURE, carried on at varying lengths of time of digestion, would afford more conclusive evidence on this subject, as it is by no means to be taken for granted that results obtained on a 48-hour digestion will be the same as those carried on for a shorter length of time. Accordingly he planned the experiments described in the paper under review, and which led to the following conclusions:—

The Van Slyke method for protein analysis, when applied to mixtures of casein and starch in the proportion of 1 to 5, and hydrolysed from 12 to 15 hours with 20 per cent hydrochloric acid gives results for the amino-acid groups that are comparable with those obtained by Van Slyke upon casein alone.

A digestion period of more than 15 hours with 20 per cent hydrochloric acid on a casein-starch mixture brings about a redistribution of the nitrogen contained in the histidin and cystin groups.

The insoluble residue obtained from a casein-starch digestion after being thoroughly washed contains nitrogen, which is not seriously affected when distilled with calcium-hydrate suspension, very small amounts being split off as ammonia or remaining in the filtrate. This indicates that the nitrogen is in an inert form and its estimation should not be included in the humin determination.

1011 — **The Influence of the Food on the Vitamine Content of the Milk.** — See No. 952 of this Review.

1012 — **Aquatic Plants Which May Be Used as a Food for Cattle: Investigations in Holland.** — *Nederlandsch Weekblad voor Zuivelbereiding en Veeelt*, Year XXIV, No. 16, p. 2. Doetinchem, June, 1918.

In view of the present scarcity of cattle food various sources of such food have been studied, among others three aquatic plants: 1) *Lemna trisulca* (duckweed); 2) *Elodea canadensis* (water-weed, ditch-moss, water-thyme); 3) *Azolla* sp. The experiments made at the cattle Food Control Station of Wageningen showed that those plants may well be utilised as a cattle food. They may be fed either fresh or washed to cattle and pigs. As at the season when these plants may be gathered there is usually sufficient green fodder, it is of special use to preserve them. As artificial desiccation would be too expensive for this purpose, it is more practical to ensilage them.

Analysis of fresh duckweed, water-weed and *Azolla* gave the following figures for each plant respectively: — Albuminoids, 1.8, 1.4, 2.3 %; fats, 0.2, 0.1, 0.3 %; starch, 2, 1.9, 5.1 %; crude fibre, 0.6, 11.0, 2.0 %; moisture, 94.3, 94.6, 88.0 %; ash, 1.1, 0.1, 2.4 %.

After desiccation these plants retain good albuminoid and starch

contents. This is shown by the following percentages (dry matter basis for duckweed, *Azolla* and water-weed respectively; — Albuminoids, 31.5, 2.6, 18 %; fats, 3.5, 1.8, 2.5 %; starch: 35, 35.2, 42.5 %.

1013 — Digestible Hay Cake and Hay Paste. — GAIN, E., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 17, pp. 539-545. Paris, May 15, 1918.

In order to utilise hay to better advantage the author states the principles by which he was governed in making digestible hay cake and hay paste, with the intention of giving later the physiological characteristics which he is still studying and which may support his claims for its practical value. He tested the use of cake prepared by his method on horses, which ate it readily. The *method of raising the yield of hay* by making *cake* and *paste* includes physical and chemical-biological procedures which permit the modification of the physical condition, digestibility, nutritive ratio and adipo-protein ratio. The aim is to increase the quantity of useful nutritive matter.

#### A. — PHYSICAL PROCESSES. — Crushing and partial cooking.

It is sufficient to crush, sift and pass the powder through an electromagnet to remove the metallic particles. By mixing the product with water, cake, lozenges, etc. may be made. Crushed oats may be incorporated. Better results may be obtained by partially cooking the cake by drying at 60°C., followed, if desired, by rapid superficial heating. The author also tested short treatment in the autoclave.

B. CHEMICAL AND BIOLOGICAL PROCESSES. — Special chemical, diastatic and fermentation treatments, to affect the chemical composition to a more marked degree than by the physical processes.

The nutritive ratio (or food quotient of hays) and the adipo-protein ratio may easily be altered; by changing them the coefficient of digestibility is modified. To the crushed hay may be added other products: — concentrated foods such as oil cakes (1 to 5 % only), small fodder seeds or flours, young leaves of forest trees, reeds, sedges, etc., and even foods with a specific action or simple chemical addition (e. g. glycono-phosphates).

C. — FERMENTATION OF THE HAY POWDER BY COMPRESSION. — The ferment actions capable of influencing the real value of hay vary in nature. They may be concerned with the different immediate principles, especially the liberation of useful elements, by attacking more or less severely the ligneous covering in which they are often enclosed. *Hay from stomachs* often give a useful flora capable of acting on the powder to be made into cake. The author made several tests with the classical diastases, *hay from ox's stomach* and *hay from sheep's stomach*, commercial yeast, a hay infusion, and, finally with partial sterilisation and the *dissociative action* of steam under pressure in the autoclave.

One of the chief elements of the value of hay lies in the seeds of the plants composing it. The harvest is, however, hastened so that the hay may be tender and ripe seeds are rarely found in hay. With digestible hay cake it would be advantageous to harvest later.

A small part of the hay might be fed as paste, the preparation of which



only requires crushing, sifting and kneading with 3 or 4 times more water than powder, by weight. The product is very similar in appearance to hay from sheep's stomach. It may be dried in the air, compressed, or fed fresh mixed with other food. Crushed seed, nettle leaves, leaves of young trees, sedges, reeds, etc., may be added.

1014 - **The Zebra and its Hybrids as Domestic Animals.**—FAWCETT, W., in *La Hacienda*, Vol. VIII, No. 8, pp. 242-245 + 9 Figs. Buffalo, N. Y., May, 1918.

For more than a century attempts have been made in various countries to utilise the zebra and its hybrids for agricultural purposes. The zebra can be bred as a domestic animal. The first hybrids were obtained by crossing a female zebra and an ass, then by crossing a female zebra with a horse, and also by crossing a mare with a male zebra. A zebra  $\times$  ass cross was obtained by LORD CLIVE towards the end of the 18th century; later on similar crosses were obtained in France and Italy. Further crosses were also obtained, especially in Great Britain, Australia and France. Crosses were obtained in Brazil in 1899 and 1900 and also in Scotland (by Prof. COSSAR EWART) between small pony mares and male zebras. HERR HAGENBECK has obtained crosses between female zebras and pony stallions.

The different species of zebra (1) have all been used for crossing, and some seem better suited than others. Burchell's zebra (which was used by Prof. EWART for crossing) has been used very often; the mountain zebra, common in South Africa, has been used. For other crosses, especially those carried out by the U. S. Government, Grevy's zebra was used. This latter is somewhat larger than the others being 52 and 56 in. high; an adult animal weighs from 770 to 880 lb. It occurs in Abyssinia and Somaliland, but it is gradually becoming rarer and rarer, while it is with difficulty transported from the place of capture to countries across the sea. Although it has never been domesticated, it is docile and would probably be easy to domesticate and rear. The male shows great dislike of mounting large mares, even if he has grown up with them from a foal. On the other hand he readily mounts small mares or she-asses.

The hybrids obtained in the United States are very vigorous and resist the cold of temperate regions as well as does the ass. They show a decided improvement over the parents as regards their form, movements, and way of standing. The average weight at birth is 48 lb.; at 1 year 275 lb., when the average height is 48 in.

The cross she-ass  $\times$  zebra are very obstinate and hard-mouthed, which constitutes an obstacle to their use as working animals. On the contrary the cross mare  $\times$  zebra is more docile and tractable, and can be used like the mule, over which it has the advantage of being much better shaped.

In crosses made in the United States between mares and zebras, the stripes in the coat of the hybrid were indistinct and the characters of the

(1) Three species of zebra are recognised:—*Equus zebra*, the common or mountain zebra *E. burchelli*; *E. grevyi*. The latter is heavier than the others, with closer and darker stripes (F. E. BEDDARD, *The Cambridge Natural History*, Vol. X, pp. 241-245, London, 1900).

mother predominated. In other crosses made in South America and Europe the characters of the father were predominant and the stripes were still more marked than those of the father.

1015 - **The Origin and Improvement of Cattle in Colombia.** — GONZALES, T. L., in *Revista agrícola, Órgano del Ministerio de Agricultura y Comercio*, Year IV, No. 1, pp. 12-25, + 2 Figs. Bogotá, January, 1918.

The first imported cattle in Colombia were brought there by the Spanish "conquistadores"; they included 37 animals, male and female, and were imported from Andalusia by RUIZ DE LUGO in 1570. The conditions were very favourable to their development, especially in the large plains of San Martín and Casanare and their numbers increased in an astonishing manner. Later there were imported into Colombia some of the cattle which had been introduced by the French and English into North America in the 16th and 17th centuries and had become acclimatised there. Finally a few selected and improved cattle were imported from the United Kingdom.

Colombia is specially suited to the production of butcher's cattle and the breeding animals sought for are those of beef breeds. The best results on the American Continent have been obtained with the Hereford, Short-horn, Angus and Galloway breeds; of these the author considers the first the most suited to all the environmental conditions of Colombia. At one time zebus were bred in Colombia, but their hybrids with the native cattle were not satisfactory, of bad form and savage nature, and producing only a medium meat.

The decree No. 77, passed in 1917 to encourage the importation of breeding stock for improving Colombian cattle and the crossing of its breeds with foreign selected breeds so as to produce stronger animals, of more rapid development and better form, granted breeders importing animals for the improvement of cattle a third of the total expenses incurred till the animal reached its destination, including the price paid for it. A sum of 50 000 *gold pesos* (£ 9 000 *at par*) has been allocated for the buying of breeding stock to be sold by auction.

1016 - **The Angora Goat in Madagascar.** — CARONGEAU, in the *Revue agricole et vétérinaire de Madagascar et Dépendances*, Year II, No. 17, pp. 110-112. Tananarive, March, 1918.

The author brought to Madagascar three male and three female Angora goats from the Naivasha Experiment Farm (Australia). The animals were sent to the ostrich farm at Tuléar where a small herd has been formed under the direction of the veterinary surgeon, M. GRANDMOUGIN.

At the end of 1915 a small herd of native goats was formed for breeding with the males. Excellent results were obtained. In 1916 the herd included 5 pure-bred males and 11 pure-bred females, as well as 9 cross-bred kids of the first generation.

On December 31, 1917, M. GRANDMOUGIN stated that the angoras had adapted themselves remarkably, to such an extent, indeed, that their vitality may be said to be superior to that of the native goats. It was possible to cure Angora goats suffering from scab, whereas, in Madagascar

[1014-1016]

goats living under the same conditions, the disease made slaughtering unavoidable, whatever treatment was adopted.

The herd is composed of 80 animals including 30 pure-breds, of which 8 are males, and cross-breds of the first and second generation. The animals pass the whole day on pasture land and receive no supplementary ration.

It has thus been proved that it is possible to breed Angora goats successfully in Madagascar. Numerous breeding centres could be formed throughout the south, as the Angora does well where the Merino can no longer live.

1017 - **Mussels as Food for Pigs: Investigations in Demark.** — *Ugeskrift for Landmaend*, No. 23, pp. 313-314. Copenhagen, June, 1918.

The following investigations were undertaken at Rosvang (under the direction of Inspector LEEGAARD) with a view to determining the efficiency of mussels as a food for pigs.

In the first experiment all the animals received per head in 10 days 66 lb. of "Mælkeriaffald" (skim and butter milk); those of Group I received in addition 56.1 lb. of barley, those of Group II 41.3 lb. of barley + 22.4 lb. of mussels ("mulsingekod") replacing 14.4 lb. of barley. The increase in live weight for one animal at the end of 10 days was 17.8 lb. for Group I and 8.6 lb. for Group II (fed on mussels).

As this experiment was made at a season when mussels are small a second one was made under much the same conditions but with younger animals. In this case the difference between the two groups was much smaller. In Group I (full grain ration) the increase in live weight per head at the end of 10 days was 13.8 lb.; in Group II (grain ration partially replaced by mussels) it was 12.5 lb.

At the end of the second experiment the quality of the meat was examined, and the flesh and fat of the pigs fed on mussels was found to have a very marked oily smell and flavour, and the melted fat a brown colour. For this reason it is advisable to stop feeding mussels some time before slaughtering. It should also be remembered that raw mussels (with the shells) only supply 10 to 14 % of flesh, so that 2 lb. of shelled mussels will replace 1 lb. of grain in the ration, whereas 16 lb. of mussels with shells are required. After boiling the mussels it was found possible to keep them in buttermilk for four or five days, even during the hottest part of summer, and the same buttermilk could then be used as food.

1018 - **Experimental Modification of Germ Cells and the Effect of Daily Inhalation of Ethyl Alcohol and other Poisons on the Progeny of Poultry.** — PEARL R. L. General Plan of Experiments with Ethyl Alcohol and Certain Related Substances, in *The Journal of Experimental Zoology*, Vol. XXII, No. 1, pp. 125-104 + 3 Figs. + 6 Tables + Bibliography of 43 Publications. — II. The Effect upon the Domestic Fowl of the Daily Inhalation of Ethyl Alcohol and Certain Related Substances, *Ibid.*, Vol. XXII, No. 1, pp. 165-185 + 4 Figs. + 6 Tables. — III. The Effect of Parental Alcoholism, and Certain Other Drug Intoxications, upon the Progeny, *Ibid.*, Vol. XXII, No. 2, pp. 311-310 + 7 Figs + 15 Tables. Philadelphia, January and February, 1917.

The aim of the experiments described was to determine whether it is

possible to modify hereditary factors in any special manner and to observe the effect of such modification from the point of view of inheritance. The problems studied were :—

1) Does the continued administration of ethyl alcohol (or other similar narcotic poisons, such as methyl alcohol and ether) to the domestic fowl induce precise and specific changes in the germinal material, thus causing new, heritable, somatic variations ?

2) In the absence of a specific effect, is there a general effect upon the germinal material leading to degeneracy of the progeny ?

3) What are the effects in general upon the soma of the subject, and do they give any clue to the probable origin and mechanism of the germinal changes ?

I. — The general plan and method, the material and subjects of the experiment are described. The animals used were hybrids from Black Hamburgs (males) and Barred Plymouth Rocks (females). Besides other advantages, the use of hybrids renders possible wider and more precise observations on the eventual variations of the inherited characters as a result of artificial poisoning and the determination of the extent to which these variations deviate from the Mendelian laws. The subjects were divided into 3 groups according to the poison administered—ethyl alcohol, methyl alcohol and ether. These substances were administered by the use of well-closed galvanised iron tanks, in which the animals were placed each day for at least one hour. The floor was made partly of heavy galvanised wire gauze which connected the tank with a cylinder below which was filled with absorbent cotton soaked in the toxic substance. Similar experiments made previously by STOCKARD have shown that the birds absolutely refuse to drink water in which the substance is placed, so that this method is impracticable.

II. — The organic and physiological effects of the inhalation of the toxic substances were studied with the following results :—

1) The *mortality* among the treated birds was much lower than among the control birds from the same parents. After 15 months' treatment the difference was 41 % in favour of the treated birds. This is opposed to the accepted idea that alcoholism shortens life. Too much importance is not attached to this fact and it is believed that as the experiments continue and include more animals this difference will gradually decrease. The photographs show that there is very little difference in the appearance of the treated and untreated birds.

2) The *body weight* of the treated birds began to increase immediately after the beginning of the treatment in autumn. This increase, which probably was not due to the treatment, was greatest in January and February and was followed by a sharp and prolonged fall till May or June, when there was another steady increase till the following February (1916). At this date the treated birds were on the average 9.9 % heavier than the untreated birds.

3) *Egg production* showed no marked difference between the treated birds or control birds ; both groups of birds laid normally in each season.

Throughout the 15 months of the experiment the average production per bird was 184.74 eggs for the controls, and 183.97 for the treated subjects; the difference — 0.77 — is negligible.

III. — The effects on the progeny of the administration of toxic substances to the parents are given, and the characters which may be expressed quantitatively are examined. Treating one or both of the parents with toxins reduced the *number of fertile eggs*, i. e. those in which a zygote was formed by the union of sperm and ovum. Pre-natal as well as post-natal mortality at all ages was lower in this case than in the control birds. The *sex ratio* of the progeny was not affected by the treatment of the parents. Treating the male only did not affect the *weight of the offspring at hatching*, but when both the parents were treated the hatching weight was superior to that of chickens from the control birds. This also holds good for the *adult body weight* of the progeny of both sexes. There was little difference in the *rate of growth* of the male offspring till after 100 days, after which the treatment of the parents resulted in a steady increase in weight. The effect on the female offspring was similar, but occurred only after 200 days.

The treatment did not affect the *proportion of abnormal chickens*, which was similar in both cases. The *Mendelian laws* were not affected, at least as regards dominance, recessiveness and sex linkage. Nothing in the experiments showed the administration of toxic substances to have any injurious effects on those germ cells which formed zygotes. The results obtained support the theory that alcohol and similar substances act as *selective agents on the germ cells* of the treated subjects. It may be assumed that the relative vigour or resisting power of germ cells varies continuously from a low to a high degree. Treatment with alcohol thus has several results:— certain germ cells will be incapacitated from forming zygotes; these are clearly the least resistant; others will produce defective zygotes; these are those which have been unable to resist the poison completely; finally, those which are not perceptibly affected will produce normal zygotes. This would explain why the progeny of parents which have been treated with toxic substances are, on the whole, superior to those of parents not so treated as regards physical resistance, vigour, development and mortality. In experiments of this kind the ratio between strong and defective zygotes depends on two variable conditions — the amount of toxic substance administered and the average resistance of the germ cells; this second factor depends on the breed.

These results corroborate those of NICE with mice, as well as the statistical data obtained among the working classes by ELDERTON and PEARSON.

1919. — **The Use of Weevily Wheat for Feeding Poultry.** — *Agricultural Gazette of New South Wales*, Vol. XXIX, Part. 4, p. 292. Sydney, April, 1918.

Methods for utilising wheat-meal made from weevily wheat for feeding poultry have been tried in the Chemist's Laboratory of the Department of Agriculture, New South Wales. A mixture of 1 of bran to 2 of wheat-meal gave a coarse mixture, but it made a good mash. One part of

[1018-1919]

bran to 3 of wheat gave a good mash of better appearance, while 1 of bran to 4 of wheat gave a mash of good appearance, that seemed too adhesive for poultry. The bran should be first scalded and then the other ingredients worked into it.

1020 — **The Use of Seaweed in Poultry Feeding** (1). — DECHAMBRE, P., in *L'Agriculture pratique*, Year LXXXII, Vol. XXXI, No. 12, pp. 230-231. Paris, June 13, 1918.

The author describes the experiments made by M. MOTTE, at Tré-gastel, Côtes-du-Nord, on the feeding of poultry with seaweed. Ten hens and ten ducklings were fed first on *Laminaria* then on all kinds of algae. The algae were freed from salt by being washed several times in fresh water (this washing is not indispensable). They were then chopped into small pieces from 3 to 5 mm. long; this is easier if they have previously been partially dried. They are then mixed with boiled crushed potatoes and put in a baker's oven for three hours or cooked over a low fire. When the whole is well jellied it is kneaded and distributed to the poultry. The ration given the poultry experimented with varied from 6.6 to 8.8 lb. of algal mixed with 2.2 lb. of potatoes. No grain was fed.

Later the potatoes were deducted from the rations for the ducks, which ate the algae alone and fattened as rapidly as those fed normally. This was also attempted with the hens which, however, refused the algae alone so that the potatoes had to be added and, later, swedes. The hens developed well, laid normally and their flesh had no peculiar flavour. The results were satisfactory in every way.

## FARM ENGINEERING.

1021 — **Agricultural Machinery in the United Kingdom** (2). — COURTNEY, F. S. (Consulting Engineer to the Royal Agricultural Society of England), in the *Journal of the Royal Society of Arts*, Vol. LXVI, No. 3416, pp. 403-415. London, May 10, 1918.

In describing the history of the development of agricultural machinery in the United Kingdom, the author draws attention to the fact that the double-furrow plough was developed by LORD SOMMERVILLE (1802) and improved by T. PIRRIE (1867). It was used for a number of years, but it fell into disuse until the last 20 or 25 years.

As early as 1866-67 the Royal Agricultural Society made an inquiry on the subject of steam cultivation, and a most interesting report gives details of the work done, which was about 6 acres *per diem*. Direct haulage of the plough by the engine was tried as early as 1865, but it was abandoned owing to the soil-packing caused by the engine. Of all the cable haulage systems, the one that has maintained its position is the double-engine system, which is still pre-eminent for efficiency. Out of 540 sets of double-engine sets at work in England, 267 are over 40 years old, 99 between 30 and 40 years old, 13 between 20 and 30 years old, 28 between 10 and 20 years old, and 133 under 10 years old. The author next considers

(1) For the utilisation of algae for feeding purposes see R. March, 1918, No. 320. (*Ibid.*)

(2) Paper read before the Royal Society of Arts at London.

the internal-combustion tractor and refers to the interesting paper by Mr. LEGROS, entitled "Traction on Bad Roads or Land" (1); he then deals with cultivators, scarifiers disc-harrows, and rotary diggers (a machine of this type was patented in 1857). After dealing with harrows, rollers, seed drills, potato planters and diggers and manure distributors, the author passes to mowing and reaping machines, harvesters, threshing machines, straw elevators, straw trussers and presses, the history of which he gives as well as the improvements they have undergone and the driving power they require. In 1849 the Royal Agricultural Society held its first trial of portable engines, built somewhat on present lines, *i. e.*, with locomotive-type boiler and horizontal engine. In 1850, as the result of further trials it was found that the engines were much improved owing to better design and the use of increased steam pressure. In 1872 still greater improvements were found.

After describing the development of road traction for carrying agricultural produce, the utility is shown of applying water and electric power to agricultural purposes. In comparison with other countries there is relatively little water power available in Great Britain, but the author advises farmers to utilise as fully as possible any such water power that is available in their district.

1022 - **Hints on the Use of an Agricultural Tractor.** — Extracted from *La Journée*, in the *Bulletin Mensuel de la Chambre Syndicale des Constructeurs de Machines Agricoles de France*, No. 3, pp. 143-144, Paris, May, 1918.

It is important, in the first place, that the field of action of the tractor should not be too wide. If it is true that the majority of tractors are well sprung nowadays, it is none the less true that their chief use is not that of running about on the road. First, these journeys waste time, petrol and oil, and end by over-working if not damaging the machine. This results in time wasted, expensive repairs, the machine being held up, and the delay of urgently-needed work, without considering that all these journeys and delays considerably decrease the daily yield of the machine and that the extra cost due to running on the road, increases the bill of the tractor. This means a higher cost for ploughing an acre, the price in reality falsified by the bad use of the tractor. For example, a 20 H.P. tractor working on an 20-acre field at the rate of 5 acres per day, will, by long, frequent journeys, decrease its yield to 2.5 and 3.7 acres, a yield which does not justify the use of a tractor.

The tractor should also be used intensively, *i. e.*, night and day, weather permitting, so as to increase its yield. In bad weather, animals should be used to do the work. It is true that with the use of chain-track tractors and the tractors used in electroculture, the slipping of the wheels in wet soil is avoided.

Another point worth considering is that tractors do not give their full yield unless they are used with such implements as are suitable to them, which is not always the case.

(1) Summarised in *R.*, July, 1918, No. 803. (*Ed.*)

For agricultural work other than ploughing, the full power of the tractor should be used so as to obtain the best yield. Thus, a 20 H. P. tractor hauling a single binder will not give a good yield; two or more binders should be hauled at once.

Similarly, light work is best done by draught animals. The tractor is not meant to do away with draught animals, but to do better than them, more quickly and cheaply, and where animal traction is obviously insufficient to attain the desired end.

These hints will be specially useful to agricultural groupings formed for mechanical cultivation.

1023 - **The Dirube and Sabaria System of Cable Traction Applied to Agriculture.** — GIAGNONI, C., in the *Revista de la Liga Agraria, Asociación Nacional*, Year XXI, Vol. XX, Nos. 9 to 12, pp. 183-193. Buenos Ayres, September to December, 1917.

With previous systems of cable traction (FOWLER and DEBAIN, HOWARD and FISCHER), nearly 25 % of the power is lost in overcoming a series of passive resistances, which, however, are said to be eliminated in the DIRUBE and SABARIA system of traction. In this the machine moves to the end of the furrow carrying with it the traction platform to which the anchored cable is attached. Meanwhile the steel cable rolls on a drum coupled to the engine in such a way that the remaining part of the cable lies on the furrow. After this the operation recommences for the next furrow up to the anchorage already prepared on the opposite headland. In this way the resistance due to pulleys and cables is avoided, thus giving an efficiency of 88 to 92 %. The inventors have patented both the machine and the fuel, which is a gas. The machine has a pull of 45 H. P.; it weighs 8 800 lb.; works a breadth of 131 in. and a depth of 6 in.; the coefficient of circular friction is 0.15; the tractive effort per sq. dm. is 60 kg., the work per hour (10 hour day with 8½ hrs. actual work), is 2.35 acres; actual work per 10-hr. day is nearly 20 acres. A driver and one assistant are required. The machine with all accessories (platform and engine, balance plough, about 5 000 ft. of metal cable, anchor, etc.) is 12 250 paper pesos (about £ 1 078). The fuel (a patent gas) is consumed at the rate of 500 gm. per H.P.-hour; it costs 25 pesos (£ 2.2s.) per metric ton. Allowing 236 working days per year, the author finds that the cost of ploughing 1 hectare is 4.02 pesos. (about 2 s. 10 d. per acre).

The inventors have also built a 60 H.P. model. They intend to exploit their invention not by selling the machines but by hiring them out.

1024 - **Trials of Disc-Harrows with Tractors, in France.** — RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year XXVII, Vol. CXXIX, n° 2, pp. 313-319 + 8 Figs. Paris, March-April, 1918.

With tractors turning the last furrows it is often necessary to use teams for scarifying and harrowing; these teams can be replaced by double-disc-harrows working over a large width and thus doing much work. They are also very suitable for preparing the soil for autumn or spring sowing by replacing the scarifying and harrowing. A seed drill



or a broadcaster may even be mounted on the disc-harrow, thus sowing during the same operation, should the state of the soil permit it.

The author deals with trials with 2 ordinary Osborne disc-harrows; on light soil that had been fallowed, with a 16 HP Mogul tractor and a 14 disc harrow, about 53 820 sq. ft. are worked per hour with a consumption of 9.9 lb. of petrol per acre; on recently ploughed land with the same machines, about the same area is cultivated (53 389 sq. ft.) with a consumption of 12.4 lb. of petrol per acre. The speed was 3662 yards per hour on fallow and 3 692 yards on recently ploughed land.

After describing the double disc-harrows (I) with smooth and toothed discs built by M. PILTER of Paris, the author gives the results of the 1917 trials, using a double disc-harrow and a seed-drill: --

	I.	II.
Average depth cultivated in inches. . . . .	2.95	4.4
Average traction in lb. . . . . total	1926.08	1258.32
" " lb. per sq. dm. (10.1 sq. ft.) . . . . .	47.74	41.5
" " lb. per disc. . . . .	31.9	49.26
Quantity of the work. . . . .	Very good.	Excellent

The angle of each disc with the direction of traction was 77° in the first trial and 74° in the second.

Under ordinary conditions the smooth discs work quite well. The toothed discs might be reserved for soil liable to cake strongly; as regards this point the author has not sufficient information to allow him to give any definite information.

1025 - **The Marti Earth-Grab.** - GACHET, A., in *La Terre Vaudoise*, Year IX, No. 35 19. 323-324 + 2 Figs. Lausanne, Sept. 1, 1918.

The Landed-Estate Improvement Society of Bioley-Orjulaz (Canton of Vaud, Switzerland) uses an earth-grab made by M. F. MARTI, of Berne, for constructing drainage canals. The earth-grab is worked by a movable steam crane. The grab is let down into the ground, into which it is driven by its own weight; the completeness of the filling depends on the nature of the ground. The steam engine then draws up the grab by means of the crane cable until the pawls on the grab engage in an automatic opening device. The grab is then let down; it opens but remains suspended by the pawls engaged in the release. When opened and emptied it is lifted slightly; the pawls release automatically and the grab can be let down again. The earth is emptied on the side of the canal for, while the crane is lifting the grab up, the machine is turned to the right or left. The grab runs along rails, which are moved forward as the work continues. The height of fall depends on the height at which the opening device can be attached to the arm of the crane.

A machine similar to that described is being used for making embankments at Eau-Froide (Canton of Vaud); the contract price is 1 franc per cubic metre; the earth-grab can dig and load 150 cubic metres a day. At

(1) See *R.*, May, 1918 No. 561. (*Ed.*)

Bioley-Orjulaz, the contractor receives the same price for work done with the machine or by hand.

1026 - **Machines Used for Harvesting Cereals in the Argentine.**—FERRÉ, J. A., in *Ministerio de Agricultura de la Nación, Dirección General de Enseñanza e Investigaciones Agrícolas, Sección Escuelas Prácticas y Viveros*, pp. 1-103 + 109 Figs. Buenos Aires, 1917.

An illustrated description of the working parts of mowers, reapers, binders, simple headers ("espigadoras"), binders-headers, etc.

In the Argentine the most commonly used makes are: the McCORMICK, DEERING, JOHNSTON, OSBORNE and CHAMPION reapers, usually cutting a 65 or 71 in. swathe; the McCORMICK, DEERING, JOHNSTON, OSBORNE and "Acme" binders, cutting 59 to 95 in.; the McCORMICK, DEERING, JOHNSTON, W. WOOD, CHAMPION headers, usually cutting 142 in.; the "La Golondrina", McCORMICK, OSBORNE, "Acme", DEERING and JOHNSTON binder-headers, cutting 142 in.; the DEERING, CRESCENT, "La Golondrina", "La Australiana" combined headers and threshers, those most used cutting 71 in., 82 in., 95 in., and requiring a team of 8 horses. By changing horses the full width of the machines can be used, thus doing 12.35 and 18.5 acres per day of 10 hours' actual work.

1027 - **The Chiesa Drier with Multiple Recipients.**—TARCHETTI, A., in *Il Giornale di Riscoltura* (Organo Mensile della R. Stazione Sperimentale di Riscoltura e delle Colture Irrigue, Vercelli), Year VIII, No. 4, pp. 54-58 + 2 Figs. Vercelli, April 30, 1918.

The author describes a new type of drier for rice and maize, made by C. CHIESA, of Milan, and sold under the name of "Automatic drier with multiple recipients". It includes 2 or more recipients, generally all of one size; the yield of the machine depends on the number of recipients. In the movable type described in the present article, there are 2 recipients; in the fixed type there are 3 or more. These machines can be worked by hand or by power.

The build of the new drier is the same as the old CHIESA type or like the ordinary type with vertical chambers or cells. In the new type, however, 2 or more machines of the old type are placed one above the other and provided with shorter vertical chambers.

In the movable type, there are 2 rows of chambers, or two superimposed recipients supported by a strong wooden frame. Under each recipient there is a horizontal, oscillating tray that carries the rice from one recipient to another placed underneath; under the last there is an inclined plane over which the grain passes into a hopper and fills the sacks.

The recipients are rectangular (19 ft. long by 3 ft. 3 in. wide and 8 in. deep) and divided into 24 cells.

The warm air from the stove passes into the recipients, whence a fan distributes it in the cells filled with grain, through which it passes into the open air. As the grain passes from the upper recipient into the lower one it is mixed, thus exposing it uniformly to the warm air. In the new drier the warm air passes vertically through the grain to escape at the

surface of the recipient; on the contrary, in the old types, the air passes horizontally through the thickness of the cell.

According to the maker, the machine produces 59 cwt. of dry rice and 88.6 cwt. of dry maize per 24 hours, with a consumption of 1 H.P. per recipient; thus the movable 2 recipient type inspected by the author produces 118.1 and 177.1 cwt., with a consumption of 2 H.P.

1028 - **The Use of Potato-Drying Plant in Rhodesia.** — NORRIS, E. A. (Director of Agriculture), in *The Rhodesia Agricultural Journal*, Vol. XV, No. 2, pp. 126-135 + 2 Tables, Salisbury, Rhodesia, April, 1918.

Considering the possibilities of exporting Rhodesian potatoes to England and owing to the impossibility of sending fresh potatoes such long distances, the author advises that they should be dried and to that end describes two British systems together with the plant necessary. The first system, that of JAMES MILNE & Son. Ltd., Milton House Works, Edinburgh, who have supplied a number of potato-drying plants to the Food Production Department in England, consists in steam-cooking the washed potatoes and passing them, by a rough crushing process, over a special type of drying machine. They are washed in a canal, about 2 ft. wide, 2 ft. deep and about 100 ft. long, with a fall of less than 1 %. A good flow of water enters with the potatoes and removes most of the sand and dirt. At the end of the canal is a grating through which the dirty water and sand escape, and the potatoes shoot down into a rotary washer with a horizontal shaft. This vat has 4 partitions with holes in each through which the potatoes pass, and revolving arms agitate them constantly in their transit from end to end of the machine. The washing is perfect and the potatoes leaving this machine are taken up a slope elevator and conveyor which distributes to hoppers over the cookers and drying machines. The cookers are arranged in duplicate over each drying machine. As the cooked potatoes emerge from the steaming vessels they are roughly crushed between small rollers, and then pass between 2 much larger steam-heated cylinders, which run practically in contact one with another; the film adhering to each cylinder dries in the course of about  $\frac{1}{2}$  revolution, and is removed by sharp knives. The drying cylinders are worked at a pressure of about 80 to 90 lb. per sq. in., and require a very special mixture of iron to be sufficiently hard and yet strong enough to resist the pressure. The flake from the drying machines is milled and sifted to remove the peel, which commands a good price as a cattle feed. The cost of the plant when installed depends on the number of machines: — £1 500, £1 800, £2 200, £2 500 for 1, 2, 3, 4 machines respectively.

The yields depend on the content of dry matter; with 15 % of dry matter in a season of 25 weeks of 60 hours each the yields for 1, 2, 3, 4 machines are 135, 270, 405, 540 tons of flour respectively and 34, 68, 102, 136 tons of peel respectively; with 25 % of dry matter for the same season the yields of 1, 2, 3, 4, machines are 225, 450, 675, 900 tons of flour respectively and 56, 113, 170, 226 tons of peel respectively.

Figures are also given showing the cost of working 1, 2, 3 or 4 machines, which varies according to the cost of fuel, etc.

The second system, that of Messrs. L. LUMLY & Co., Ltd., the Minories, London, consists in evaporating the water of the potatoes in their "Invicta" fruit and vegetable dryer and evaporator, which is made in 5 sizes. It consists of a furnace for heating air which passes through an inclined chest or frame filled with trays on which are laid the potatoes, fruit or vegetables to be treated. The greatest heat is concentrated upon a tray when it first enters the machine, and each tray subsequently introduced pushes the previous one into a lower temperature. The circulation of the hot, dry air ensures rapid desiccation of the outside, so that colour and flavour are unimpaired. By this process thin-sliced potatoes can be rapidly changed into a hard, light, dry form which will keep and bear freight to distant points for further manufacture or consumption.

Beside these systems the author says there are many others, duly protected by patents, such as those of H. G. BENJAMIN, New York, and the ALLIANCE VEGETABLE Co., Ltd., London.

1029 - **New Applications of Artificial Cold.**—FICHER, A., in *Le Génie Civil*, Year XXXVIII, Vol. LXXII, No. 22, pp. 396-399 + 9 Figs. Paris, June 1, 1918.

Owing to present-day needs the application of cold to industrial purposes has much increased, especially in the way of constructing cold-storage motor-vans and small cold-storage vehicles for the use of the armies in the field, for preserving vaccines, serums, meat, perishable food-stuffs, and, recently, the construction of new types of cold-storage trucks that are an improvement over those previously used. These different applications of cold have been made possible by the use of the AUDRIFFEN-SINGER'S refrigerator which is absolutely automatic, not requiring a mechanic to attend to it, as the machinery is enclosed in a hermetically sealed case.

This refrigerator consists of two hollow metal balls joined by a shaft whose end bears a pulley serving to give a rotatory movement. One ball acts as a freezer, the other as a condenser. These are placed on two tanks, one containing water and the other a non-freezing brine. When the apparatus is rotated the brine tank cools down while the water is warmed in the other tank owing to the compression. A stream of cold water is therefore necessary, as with all freezing machines, to maintain a suitable temperature in the condensing tank.

The ordinary freezing agents—ammonia, sulphurous anhydride, methyl chloride, etc.—can be used. A detailed description of how the machine works is given, the principle being that of most refrigerators:—liquefaction of a gas by compression and cooling and evaporation of the liquid thus obtained by decompression. Owing to its extreme simplicity the machine has been used by various of the French Ministries, especially for the production of pure ice near front-line hospitals, for troops in the field in the colonies, for preserving serums and vaccines, and for cold-storage transportation. The author describes all these applications in detail. The A-S refrigerator has been adopted by the American Army Transport Commission in France for the refrigerator waggon which are to be built, on account of its simple construction, which allows it to be

left alone indefinitely without any fear of it going wrong or deteriorating. In the refrigerator waggons a small room is cut off from the length of the waggon by means of an interior wall. In this room a refrigerator of 3 000 "frigories-heure" (1) is installed with a pump and a small fan. The driving power is provided from the waggon axle. A governor prevents the speed exceeding a certain point which can be adjusted as required.

Six large brine pipes are fixed on the roof of the waggon of sufficient capacity to provide for refrigerating the waggon in case of a 12-hour stop. The fan distributes the air to assure a uniform temperature in all parts of the waggon.

The floor, roof and walls are insulated against heat by a covering of wood fibre and compressed cork slabs. To avoid too great changes of temperature, a thermostat acts on the salt pump, limiting its action when the temperature descends below  $+3^{\circ}\text{C}$ . A 10-ton waggon can carry some 8 800 lb. of goods. These waggons will be used for carrying meat and fruit from the south of France.

#### 1030 - Review of Patents.

TILLAGE MACHINES AND IMPLEMENTS. — *Canada*: 182258 Disc sharpener.

*Sweden*: 42146 Motorplough; 42193 Device for agricultural machines; 42194 Lifting and lowering device for agricultural machines; 42305 Scraper.

*United Kingdom*: 115198 Plough; 115328 Balance plough; 115553 Cultivator.

*United States*: 1265491 Soil pulveriser; 1265526 Ridging and pulverising machine; 1265979-1266049 Harrows; 1266328; Disc harrow attachment; 1266489 Spring toothed harrow; 1266502 Motorplough; 1266719 Agricultural implement; 1266753-1266754 Plough structure; 1266877 Gang plough.

DRAINAGE AND IRRIGATION. — *United States*: 1264906 Ditching machine.

MANURES AND MANURE DISTRIBUTORS. — *Sweden*: 42147 Manure spreader.

*United Kingdom*: 115491 Manure distributor.

*United States*: 1266174 Manure loader; 1266068 Straw spreader.

DRILLS AND SEEDING MACHINES. — *Denmark*: 22976 Potato planter.

*Sweden*: 42195 Mechanism for seeding machine; 42196 Seed distributor; 42426 Drill and dibbler.

*United States*: 1265323 Cotton seed dropping mechanism; 1265430 Cotton planter; 1266634 Transplanter; 1267006 Check row attachment for maize planter; 1267011 Maize planter frame construction; 1267115 Maize planter.

VARIOUS CULTURAL OPERATIONS. — *Sweden*: 42307 Horse hoe; 42428 Support for growing plants.

(1) The "frigorie-heure" represents the number of calories removed in cooling a body i.e., negative calories. See MOLINARI, *Trattato di chimica generale ed applicata all'Industria*, Vol. I, p. 354. Milan, 1918. (Ed.)

*United States* : 1265296. Vine cutter ; 1265710 Cane or maize topper or header ; 1265776-1265902-1265962-1267149 Cultivators ; 1266005 Cotton chopper and cultivator ; 1266918 Wheel hoe ; 1266964 Hand wheel hoe ;

CONTROL OF DISEASES AND PESTS OF PLANTS. — *France* : 487121 Weed killer ; 487131 Sprayer for sulphating vines.

*Sweden* : 42307 Rat trap.

*Switzerland* : 78386 Sprayer.

*United States* : 1265481 Insect trap.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Denmark* : 23038 Fruit picker.

*Switzerland* : 78385 Hand mower.

*United Kingdom* : 115268 Mower.

*United States* : 1265410 Fruit picker ; 1265635 Scythe ; 1265649 Hay rake ; 1266984 Pitman connection for mower ; 1267138 Pea harvester.

MACHINES FOR LIFTING ROOT CROPS. — *Canada* : 182268 Potato digger.

*Denmark* : 23059 Turnip digging machine.

*Sweden* : 42272 Root topping machine ; 42465 Root digging machine.

*United States* : 1266376 Potato digger ; 1266439 Beet harvester.

WINNOWER MACHINES. — *Sweden* : 42427 Apparatus for cleaning bilberries, peas, etc.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *Canada* : 182378 Bin ventilator ; 182485 Hay press.

*Switzerland* : 78505 Hay press ; 78542-78543 Crushing, milling, grinding machines.

*United Kingdom* : 115518-115544-115547 Scenting machines.

*United States* : 1265014 Cotton seed linter ; 1265969 Hay loader ; 1266861 Packing means for silos.

FORESTRY. — *Denmark* : 22963 Portable saw driven by compressed air for felling and sawing trees.

*Switzerland* : 78504 Faggot-making machine.

TRACTION AND STEERING OF AGRICULTURAL MACHINERY. — *Canada* : 182481 Plough coupler.

*Denmark* : 22964 Windmill with multiple pairs of wings.

*France* : 487045 Anchoring system for mechanical ploughing apparatus.

*United Kingdom* : 115124-115277-115398 Tractors ; 115269 Traction engine ; 115467 Agricultural motor tractor.

*United States* : 1265114 Water motor ; 1265118 Caterpillar tractor ; 1265388-1266904-1267028-1267122 Tractors ; 1266710 Tractor hitch for harvesting machine ; 1266781 Traction attachment for motor vehicles ; 1266910 Windmill ; 1267027 Tractor coupling device.

HOUSING OF LIVESTOCK. — *United Kingdom* : 115182 Horse shoe.

*United States* : 1265534 Horse shoe.

POULTRY FARMING. — *United States* : 1265548 Chicken brooder ; 1265717 Incubator thermometer attachment.

APICULTURE. — *Sweden*: 42274 Honey extractor.

*United Kingdom*: 115355 Honey extractor.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *United Kingdom* -

115317 Baker's oven; 115067 Potato flour.

DAIRYING. — *Canada*: 182454 Milking machine.

*Denmark*: 22999 Apparatus for lifting and emptying milkcans.

*Sweden*: 42273 Separator; 42353 Low pressure engine for milk separator; 42464 Suction milking machine; 42498 Milking machine; 42499 Rolled metal bowl for a separator.

*Switzerland*: 78417 Process for storing fresh butter.

*United States*: 1265914-1266544-1266697-1266795 Milking machines.

FARM BUILDINGS AND EQUIPMENT. — *United Kingdom*: 115435 Apparatus for holding horses during shoeing.

VARIOUS. — *Canada*: 182280 Centrifugal pump.

*Sweden*: 42398 Automatic watering device for flower pot.

## RURAL ECONOMICS.

1031 - **Farm Management and Farm Profits on Irrigated Land in the Provo Area (Utah Lake Valley), U. S. A.** — CONNOR, L. G., in the *U. S. Department of Agriculture Bulletin* No. 582 (Office of Farm Management), pp. 1-10. Washington, D. C., January 7, 1918.

The farm-management survey discussed in this bulletin was made in 1914. The object of the survey was to determine, approximately, the profits that farmers receive in the irrigated area of the intermountain region.

The 104 farms studied were divided into the following classes: — 1) owners; 2) owners renting additional land; 3) tenants.

The 75 records from farm owners were divided into three groups, as shown in Table I. The first group represents fruit and sugar-beet or truck farms, no one of which is as large as 27 acres, and most of them much smaller. The chief cash crops are fruit, beets and truck, other crops being quite unimportant on these small units.

The second group comprises those farms of more than 27 acres in size, but on which practically the same crops are grown as on those in the first class. Productive live stock (usually stock other than work animals) is of but minor importance in either division. The farmers operating more than 27 acres derive a greater proportion of their crop receipts from grain, hay, and sugar beets than from fruit. Considerably more than half of the total receipts comes from the sale of crops in both of these groups.

The third group comprises the live-stock farms from which records were secured. Practically half of the total receipts on these farms comes from the sale of stock and animal products, while only a little more than half of the total receipts comes from the sale of crops. The most important cash crop is the sugar beet, and fruit is a minor consideration if present.

TABLE I. — *Average area, capital, receipts, expenses, farm income, and labour income on 75 farms operated by their owners (Utah Lake Valley).*

Item	Group I (26 small farms)	Group II (29 fruit and beet farms)	Group III (20 livestock farms)	All farms
Size of farms . . . . . Acres	16.48	77.20	106.65	63.99
Tillable area per farm . . . . .	15.04	56.64	68.06	45.26
Crop area per farm . . . . .	13.34	46.05	47.81	35.18
Capital . . . . . Dollars	6 142	13 337	16 507	11 688
Receipts . . . . .	1 311	2 460	3 793	2 417
Expenses . . . . .	654	1 195	1 574	1 105
Farm income . . . . .	657	1 265	2 219	1 312
Labour income . . . . .	350	598	1 394	728

Table II presents the results from 22 farms where the operator owns an area which he deems too small for profitable farm management and rents additional land. This method of operation is becoming more and more general in this region as elsewhere, with the rise in land values. It represents a step midway between tenant and owner, and is very effective in enabling men with limited capital to increase their labour income with but a small increase in their investment. The first group in Table II, with but three-fifths as much capital as the small owners in Table I (\$3 597 as against \$6 142), made considerably more labour income (\$398 as against \$ 350). They raised but little fruit, devoting a large part of their crop area to sugar beets. The size of farm and the crop area is a little larger than in group I, Table I.

TABLE II. — *Average area, capital, receipts, expenses, farm income, and labour income on 22 farms operated by owners, renting additional land (Utah Lake Valley).*

Item	Group I (8 small farms)	Group II (14 general farms)	All farms
Size of farm . . . . . acres	20.03	113.25	79.35
Farm area owned . . . . .	8.03	89.18	59.67
Additional area rented . . . . .	12.00	24.07	19.68
Tillable area per farm . . . . .	18.59	47.62	37.07
Crop area per farm . . . . .	17.00	43.70	33.00
Capital . . . . . \$	3 597	8 041	6 425
Receipts . . . . . \$	1 026	2 197	1 770
Expenses . . . . . \$	418	1 095	850
Farm income . . . . . \$	578	1 102	911
Labour income . . . . . \$	398	700	500

The second division in Table II comprises 14 farms comparable to those of the same group in Table I. With less than two-thirds as much



capital, they make practically one-fifth more labour income than the larger owners operating fruit and general farms.

The last group in Table II shows the results for all the farmers renting land in addition to the area owned.

These farms are compared with the last group in Table I which presents the average for all farms operated by their owners. The average tillable and crop area in the two classes under discussion is a proper measure of size.

On somewhat smaller farms, and with a little over half as much capital as the average owner, the farmers renting additional land made an average labour income of \$ 590, or nearly six-sevenths as much as that of the straight owners (\$ 728). The greater proportion of live-stock on farms run by owners accentuates the difference in labour income in their favour.

The average labour income of all the owners and owners with additional land rented is \$ 697. The average capital is \$ 10 096. This compares favourably with returns from a similar size of business in other parts of the country.

TABLE III. — *Average area, capital, receipts, expenses, farm income and labour income on 18 dairy farms (Utah Lake Valley).*

	Average			Average	
Size of farm . . . . . Acres	119.46		Receipts . . . . . Dollars	4 227	
Tillable area per farm . . . . . "	82.88		Expenses . . . . . "	1 872	
Crop area per farm . . . . . "	57.46		Farm income . . . . . "	2 355	
Capital . . . . . Dollars	18 562		Labour income . . . . . "	1 427	

TABLE IV. — *Average area, capital, receipts, expenses, farm and labour income on seven tenant (rented) farms (Utah Lake Valley).*

	Farm	Tenant	Landlord
Size of farm . . . . . Acres	89.08	—	—
Tillable area per farm . . . . . "	79.11	—	—
Crop area per farm . . . . . "	58.23	—	—
Capital . . . . . \$	—	\$ 1 117	\$ 17 469
Receipts . . . . . "	—	2 118	1 167
Expense . . . . . "	—	1 050	589
Farm income . . . . . "	—	1 068	1 028
Labour income . . . . . "	—	1 012	—
Per cent on investment . . . . . %	—	—	5.793

Table III presents the average of all the dairy farms included in the survey. Not all are operated by owners, there being two tenant farms included and two which are operated by owners with additional land rented. These are handled statistically as though run by straight owners, the operators being charged with the landlord's expenses, credited with

TABLE V. — *Distribution of farm receipts and of crop receipts on farms operated by their owners and on farms whose owners rent additional land.*

Source of receipts	On 75 farms operated by their owners				On 22 farms operated by owners renting additional land			Average (97 farms)
	Group I	Group II	Group III	Average	Group I	Group II	Average	
	(26 small farms)	(29 beet and fruit farms)	(20 live-stock farms)	(75 farms)	(8 small farms)	(14 general farms)	(22 farms)	
	%	%	%	%	%	%	%	%
Crops . . . . .	58.2	60.2	24.9	44.6	63.7	47.8	51.2	46.2
Stock . . . . .	4.0	4.2	5.2	4.9	2.5	5.6	5.0	4.6
Stock products . . . . .	4.0	3.5	45.0	21.0	3.1	15.3	12.7	19.6
Miscellaneous . . . . .	11.2	5.7	1.1	4.8	14.0	4.8	6.8	5.2
Increase of inventory . . . . .	22.6	26.1	23.5	24.7	16.7	26.5	24.3	21.1
<i>Total receipts . . . . .</i>	<i>\$ 1 311</i>	<i>\$ 2 460</i>	<i>\$ 3 793</i>	<i>\$ 2 417</i>	<i>\$ 1 026</i>	<i>\$ 2 197</i>	<i>\$ 1 770</i>	<i>\$ 2 211</i>
Maize . . . . .	—	—	0.4	0.1	—	—	—	0.1
Potatoes . . . . .	7.5	2.8	4.6	4.3	13.3	8.0	9.4	5.3
Wheat . . . . .	1.1	5.3	0.6	3.1	6.0	4.6	5.0	3.3
Oats . . . . .	—	0.3	0.1	—	—	2.9	1.4	0.5
Hay . . . . .	0.6	6.7	2.1	4.2	0.6	4.3	3.3	4.0
Beets . . . . .	21.2	26.9	82.9	38.4	72.4	60.0	63.5	43.4
Truck crops . . . . .	8.5	4.1	1.4	4.6	3.4	8.3	7.0	5.1
Apples . . . . .	21.2	11.2	6.2	12.4	3.2	5.0	4.4	10.9
Peaches . . . . .	23.0	15.6	0.5	13.9	—	5.3	3.9	11.9
Other fruit . . . . .	16.0	24.8	0.9	17.2	1.1	2.5	2.1	11.1
Miscellaneous crops . . . . .	0.9	2.3	0.3	1.6	—	—	—	1.2
<i>Total crop receipts . . . . .</i>	<i>\$ 163</i>	<i>\$ 1 481</i>	<i>\$ 945</i>	<i>\$ 1 089</i>	<i>\$ 653</i>	<i>\$ 1 049</i>	<i>\$ 985</i>	<i>\$ 1 049</i>
<i>Distribution of farm expenses.</i>								
<i>Items of expense . . . . .</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>
Paid labour and board . . . . .	22.2	20.4	25.2	22.3	15.1	18.8	18.2	—
Family labour . . . . .	9.5	15.2	13.9	14.0	8.5	10.0	9.8	—
Improvement and new equipment . . . . .	22.2	21.6	17.0	21.0	—	19.9	16.1	—
Repairs . . . . .	3.6	4.3	3.7	3.9	8.5	3.5	4.4	—
Feed . . . . .	11.5	6.6	14.1	10.5	9.8	7.8	8.1	—
Horseshoeing . . . . .	1.5	1.2	1.2	1.2	1.3	1.2	1.2	—
Seed and fertilisers . . . . .	2.2	1.6	0.5	1.3	1.1	1.1	1.2	—
Spray material . . . . .	2.2	2.1	0.3	1.4	0.4	0.9	0.8	—
Machine work hired . . . . .	3.1	2.5	2.7	2.7	0.9	2.9	3.7	—
Interest, taxes, etc. . . . .	10.9	12.0	11.1	11.1	35.2	22.8	25.1	—
Miscellaneous (including decrease inventory) . . . . .	6.4	6.7	4.1	5.4	3.6	4.8	4.1	—
Stock purchased . . . . .	6.7	2.8	6.2	4.9	9.6	6.3	7.0	—
<i>Total expenses . . . . .</i>	<i>\$ 643</i>	<i>\$ 1 195</i>	<i>\$ 1 574</i>	<i>\$ 1 105</i>	<i>\$ 448</i>	<i>\$ 1 095</i>	<i>\$ 859</i>	<i>\$ —</i>

the corresponding receipts and interest on the landlord's investment deducted from the farm income to secure the labour income.

Table IV presents the results secured from 7 farms operated by tenants. The tenants made a labour income of \$ 1 012, and the landlords 5.79 % on their investment.

*Renting compared with buying.* — From the preceding tables it seems very clear that the farmer with limited capital should rent rather than buy land in this area. The prevailing rate of interest on farm mortgages is 8 % (1914). The average owner of the 22 renting additional land had the use of \$4 447 in real estate belonging to the landlords, and paid only 4.5 % for it (\$ 182). The tenants paid less than 6 % on the average, but with only \$ 1 100 owned capital they made labour incomes much larger than the farmers in Table II or in the first two groups in Table I.

*Distribution of receipts.* — Table V shows the percentage distribution of farm receipts under the different headings (crops, stock, stock products, miscellaneous including outside labour, and increase of inventory less decrease) as well as the percentage distribution of crop receipts and of expenses.

*Work horses.* — The data concerning the number of work horses per farm and the crop acres per horse are presented in Table VI. The small farms have 1.94 work horses and only 7.32 acres of crops per horse. This shows a relatively low efficiency of the farm draft. With the total cost of keeping a horse a year ranging from \$ 70 to \$100, the inefficient use of farm draft on small farms represents an appreciable reduction of the labour income unless the horses can be used in idle periods at outside work. The average charge per crop acre for horse labour would therefore range between approximately \$ 6.40 and \$ 9.

TABLE VI. — *Number of work horses and crop area per horse*  
(Utah Lake Valley).

Farm group	Number of farms	Number of work horses	Crop area per horse acres
Small farms . . . . .	34	1.94	7.32
General and fruit farms . . . . .	49	3.71	12.14
Dive stock farms . . . . .	21	4.60	11.30
Total or average . . . . .	104	3.31	10.68

*The farmer's labour and the influence of outside labour on labour income.* — An estimate was obtained from each farmer on the values of the work done by him for that year. The average of all these estimates was \$ 429, which is considerably higher than the average labour income earned by the small owner, or small owner with additional land rented. The actual wages paid to dependable men by the year were frequently

higher than the estimates of the farmers as to the value of their own year's work. These wages usually range (1914) from \$ 420 to \$ 480 per year.

The importance of outside labour in increasing the labour income of the small operators is shown in Table VII. The size of business on these small Utah farms is comparable with farms very much larger in area in non-irrigated sections. The intensive type of farming followed on irrigated land calls for a labour supply commensurate with the size of business, but the operator and his family are often confronted with slack periods of considerable duration during the crop growing season, because the farms are not large enough to permit a widespread adoption of enterprises which would call for labour in the idle periods. The small farmers in the Provo area took advantage of these periods of farms inactivity to earn large additions to their farm receipts. An interurban trolley line built into Provo created a much greater demand for man and team labour than ordinarily exists in this section. These receipts from outside labour increased the labour incomes by more than 50 % in the case of the small owners and small owners with additional land rented.

TABLE VII. — *Importance of outside labour in increasing income on small farms (Utah Lake Valley).*

Item	Group I (15 small farms with 20 % or more of receipts coming from outside labour)	Group II (26 small farms (owners) showing amount of receipts from outside labour)	Group III (8 small farms (owners) with additional land rented showing receipts from outside labour)	Group IV (29 large fruit farms and best farms (owners) showing receipts from outside labour)
Size of farm . . . . . acres	18.06	16.48	20.03	77.20
Crop area per farm . . .	14.25	13.34	17.00	46.05
Capital . . . . . \$	5 362	6 142	3 597	13 337
Receipts . . . . .	1 176	1 311	1 026	2 460
Labour income . . . . .	430	359	398	598
Receipts from outside labour . . . . .	301	141	135	96
Percentage of labour income from outside labour . . . %	70	39	34	16

*Results by type of farming as well as by size.* — In the preceding tables the various data and the returns for work done have been presented by size of farm. In Table VIII they are presented by type of farming followed. All the farms were tabulated which could be used in the six classifications of (1) small fruit, (2) small general, (3) large fruit, (4) large general, (5) dairy and (6) poultry farms. In arriving at the amount of labour used the value of extra labour hired was all reduced to a man-time basis at \$ 2 per day, the regular daily wage. When members of the farm family worked the value of their labour (above their board) was reduced to man time at the prevailing rate of wages for hands hired by the month

TABLE VIII. — *Labour used on different types of farm and the returns for labour.*

	Small fruit farms	Small general farms	Large fruit farms	Large general farms	Live-stock farms	
					Dairy	Poultry
Number of farms . . . .	16	18	17	24	18	4
Average per farm :—						
Acreage . . . . .	17.47	17.18	51.2	62.08	119.50	8.87
Crop acreage . . . . .	14.29	14.12	41.08	45.65	57.46	8.00
Capital . . . . . \$	6,248	6,400	13,915	13,125	18,562	6,046
Crop sales . . . . . \$	804	700	1,630	2,311	1,088	278
Stock sales . . . . . \$	62	30	206	103	235	160
Stock product sales . . . \$	47	50	108	146	1,745	859
Miscellaneous receipts . . \$	155	140	159	105	50	—
Labour income . . . . . \$	302	383	611	640	1,427	483
Costs of man labour used	17.24	14.46	24.57	20.29	30.75	15.15
Animal units . . . . .	4.33	4.31	9.25	8.81	31.61	10.60
Grain { acres . . . . .	1.80	3.33	4.78	15.25	12.11	2.50
{ bushels . . . . .	68	140	196	497.50	527	110
Fay and fodder { acres . . . . .	3.10	2.70	17.79	11.07	30	1.25
{ tons . . . . .	9.66	8.50	52.40	37.42	102	5.25
Beets { acres . . . . .	0.38	5.42	0.76	11.96	10.37	2.10
{ tons . . . . .	6.00	89.20	10.60	182.92	194.25	41.30
Fruit { acres . . . . .	6.51	1.70	14.55	3.80	2	1
{ bushels . . . . .	1,542	180	2,865	512.38	231.5	184.5
Non-bearing fruit . . . . . acres	1.94	0.17	5.00	1.85	0.35	0.4
Other crops . . . . .	1.56	1.58	1.77	2.98	3	0.6
Crop area in intensive crops % . . . . .	72.7	62.8	53.8	45.1	27.5	51.2
Crop area per man . . . . . acres	10.0	11.7	20.1	27.08	22.3	6.34
Days of labour per crop acre . . . . .	1.206	1.024	0.598	0.444	0.537	1.894
Labour income per month of labour . . . . . \$	17.52	26.48	24	31.83	46.41	32.54
Number of work horses per farm . . . . .	1.9	1.97	3.7	3.4	5.2	1.5
Crop area per work horse acres	7.52	7.17	11.10	13.43	11.01	5.33

These results show that the type of farming followed, as well as the size of business, is an important determining factor in the net return to the large orchardist, while in the case of the general farmers size of business is the chief factor in their net returns. The size of business is an important factor in the large net return on the dairy farms, but the type of farming appears of equal importance. Most of the labour used on these farms works longer hours than on the other types and the labour is performed on enterprises all of which give good returns.

In connection with the study of the type of farming as presented in

Table VIII, it is particularly interesting to analyse the data presented in Table IX in which the labour requirements of the important crops grown on these farms are presented in detail, with special reference to extra days of man labour which are given in the footnotes. By consulting these two tables a good idea can be secured not only of the farm business as a whole but also of the demands on the time of the operator in producing the different crops.

TABLE IX. — *Labour requirement of crops.*

Crop	Winter 96 days 46 avail- able	March 1 to May 1 60 days 35 avail- able	May 1 to July 1 61 days 42 available	July 1 to September 1 62 days 50 available	September 1 to November 1 61 days 42 available	November 1 to December 1 30 days 20 available	Total
<i>Days per acre of man labour.</i>							
Strawberries . . .	1.50	0.17	36.01 <sup>(1)</sup>	2.67	—	—	40.38 <sup>(1)</sup>
Raspberries . . .	1.50	8.17	7.33	14.00 <sup>(2)</sup>	—	—	61.00 <sup>(2)</sup>
Peaches . . . . .	—	6.24	1.75	3.13	22.00 <sup>(3)</sup>	0.50	33.62 <sup>(3)</sup>
Prunes . . . . .	—	5.88	3.20	0.88	22.00 <sup>(3)</sup>	0.50	32.46 <sup>(3)</sup>
Pears . . . . .	—	5.67	2.25	4.38 <sup>(5)</sup>	9.50 <sup>(6)</sup>	—	21.80 <sup>(6)</sup>
Apples . . . . .	—	4.92	1.75	3.28	14.00 <sup>(7)</sup>	—	23.95 <sup>(7)</sup>
Alfalfa . . . . .	—	0.17	0.83	1.03	0.83	—	2.86 <sup>(8)</sup>
Canning peas . . .	—	1.54	1.50	3.50	—	—	9.54 <sup>(9)</sup>
Small grain . . . .	—	0.82	0.35	1.38	—	0.67	3.22 <sup>(10)</sup>
Snap beans . . . .	2.00	1.00	1.91	26.25 <sup>(12)</sup>	—	—	31.19 <sup>(12)</sup>
Tomatoes . . . . .	1.50	2.10	5.07	15.67 <sup>(13)</sup>	12.00 <sup>(13)</sup>	1.00	37.34 <sup>(13)</sup>
Potatoes . . . . .	1.50	2.00	2.09	1.15	4.00 <sup>(14)</sup>	1.00	12.64 <sup>(14)</sup>
Onions . . . . .	1.50	3.17	5.84	2.67	21.20 <sup>(15)</sup>	3.66	38.04 <sup>(15)</sup>
Sugar beets . . . .	2.00	0.97	3.07	1.75	6.25 <sup>(17)</sup>	1.00	13.94 <sup>(17)</sup>
<i>Days per acre of horse labour.</i>							
Strawberries . . .	3.00	—	5.67	0.50	—	—	9.17
Raspberries . . . .	3.00	—	1.67	6.00	—	—	10.67
Peaches . . . . .	—	2.81	1.67	1.50	5.00 <sup>(4)</sup>	1.00	11.08 <sup>(4)</sup>
Prunes . . . . .	—	3.11	3.28	—	6.00	1.00	13.42
Pears . . . . .	—	1.67	1.33	1.00	3.00	—	7.00
Apples . . . . .	—	2.50	1.00	0.80	8.00	—	12.30
Alfalfa . . . . .	—	—	0.05	0.05	0.05	—	0.25
Canning peas . . .	—	2.63	4.00	4.00	—	—	10.63 <sup>(16)</sup>
Small grain . . . .	—	1.30	—	0.73	—	1.33	3.36
Snap beans . . . .	4.00	1.67	1.53	3.00	—	—	10.20
Tomatoes . . . . .	3.00	1.27	2.28	4.75	4.00	2.00	17.30
Potatoes . . . . .	3.00	2.47	1.80	0.25	4.00	2.00	12.80
Onions . . . . .	3.00	1.33	0.50	—	3.20	7.31 <sup>(16)</sup>	15.37
Sugar beets . . . .	4.00	1.60	1.53	0.50	6.15 <sup>(18)</sup>	2.00	15.78

The figures in the above table include extra labour, mainly at harvest times, which in all cases, even when done by children, is reduced to the equivalent of man time. This extra labour is as follows:—

(1) Extra day man labour, 22.68 in third column; 0.2 in other columns.

(2) " " " " 34.50 in column 4; 0.50 " " " "

(3) " " " " 20 in column 5; 1.34 " " " "

- (4) Extra days horse labour, 3 (hauling).
- (5) Extra days man labour 17 in column 5; 2.28 in other columns.
- (6) " " " " 8 in column 4 and 5; 2 in other columns.
- (7) " " " " 8 in column 5; 1.50 in other columns.
- (8) " " " " 0.75 evenly distributed at each cutting.
- (9) Total extra days man labour 0.77.
- (10) Total extra days horse labour 0.2 (planting).
- (11) Total extra days man labour 0.80 (at harvesting and thrashing).
- (12) Extra days man labour 22.50 (picking by boys and girls).
- (13) Extra days man labour 18 in columns 4 and 5 (picking mainly women and children); in other columns 1.25.
- (14) Extra days man labour 2 (digging) in column 5; 0.9 in other columns.
- (15) Extra days man labour 13.60 (digging) in column 5 (harvest mainly children); 5.33 in other columns, of which 4 are used in weeding before Sept 1 (done by boys).
- (16) Extra days horse labour 2.67 (hauling).
- (17) Extra days man labour, 5 in column 5 (harvesting), 1.07 in other columns includes thinning about June 1 (done by boys).
- (18) Extra days horse labour, 3.75 (hauling beets).

The factors which apparently control the income of the farmers in the area surveyed, according to the data presented in the previous tables seem to warrant the conclusion that the greatest need of the small farmers in this district is more land to work, and that diversification, also when needed, is not nearly as important as an increase in size of farm. A market crop which is more certain than fruit, particularly sugar beet, should be the proper diversification for the increased farm.

A further increase in the number of very small farms in this region seems to be unwise. About 30 acres seems to be the smallest size for efficient management without much reliance on live stock. Forty to fifty, preferably fifty acres, seems to be the smallest unit for efficient management where live stock enterprises are given a prominent place by the typical farmer. This is specially true for dairying.

The general farms which grow truck and fruit as secondary enterprises approximate the ideal cropping combination for this region.

1032 - **The Economic Results of the Overhead Irrigation of Strawberries in Illinois, U. S. A.** — ADRIAN, J., in *System on the Farm*, Vol. II, No. 4, pp. 134-135 + 1 Plate. Chicago, April, 1918.

In 1916, after having grown strawberries for 12 years without irrigation, the author installed an overhead irrigation system (1). The cost of installation was \$1200 for 6 acres, or \$200 per acre. The water is derived from the municipal supply, and is charged for per cubic foot, the yearly cost of irrigation amounting to \$60 for the 6 acres. The average amount of water required for the whole area is 1400000 gallons a year. The irrigation pipes are placed in parallel lines 50 feet apart. This distance allows the water from two parallel pipes to meet in the middle.

All the field, with the exception of 1 acre of autumn fruit, is planted

(1) See B. 1914, Nos. 486 and 627; B. 1914, No. 1090; B. 1915, Nos. 95 and 1330; R. 1927, Nos. 408 and 708. (Ed.)

with spring fruit, but, in time, the author intends to grow the autumn variety exclusively because of the greater profit obtained from it.

During 12 years the average receipts from strawberry growing without irrigation were \$ 188.56 per acre, and the average profits \$ 125.54. With overhead irrigation the average receipts per acre were \$ 542.86, and the average profits \$ 362.00.

### AGRICULTURAL INDUSTRIES.

1033 - **A New Method for Determining the Watering of Wine** (1). — PRATOLONGO, U., in *Le Stazioni sperimentali agrarie italiane*, Vol. I, I, Pt. 1-2, pp. 56-60. Modena, 1918.

The problem of diagnosing the watering of wine has not yet been satisfactorily solved, but, according to the author, it is not only possible to show watering, but, under certain conditions, easy.

The method reported in 1912 by Prof. PAGNOTTA is based on the fact that natural wine forms a saturated solution of mono-potassic tartrate and calcium tartrate. If the wine to be tested is saturated with mono-potassic tartrate and the difference between the tartrate dissolved and the added tartrate and residue determined, it should be possible to calculate the amount of water added. The author made a series of investigations into the solubility of mono-potassic tartrate and calcium tartrate in hydro-alcoholic solutions, with respect to the temperature, and content in alcohol and tartaric acid, considered as variables. He also investigated the influence on the solubility of these two salts of the chemical treatments and changes to which wine may be subjected.

The results of his study led him to believe that it is possible to show with certainty the watering of wine even with quantities as small as 5 to 10 %. It is, moreover, possible to show the presence of other prohibited matter, such as, for example, sulphuric acid, even if the amount is too small to be detected by other analytical methods. The method is not only qualitative, but also quantitative when the water added varies from 5 to 20 %. The author proposes to study the influence of changes which wine undergoes during ageing and through diseases. The method does not permit the detection of water added to the must.

The method may be outlined as follows:— The wine to be tested is saturated with mono-potassic tartrate and calcium tartrate separately, the contact of the two salts in excess being kept at a temperature of from 50-60° C. for half an hour. The excess of mono-potassic tartrate and calcium tartrate dissolved is allowed to settle by cooling, and, in the wine thus saturated, the following points are determined:— 1) the difference in the amount of mono-potassic tartrate dissolved and the two comparative acidometric determinations made with non-saturated wine and wine saturated with mono-potassic tartrate; 2) the amount of calcium tartrate dissolved, with the determination by weight of the total calcium in the wine before and after saturation.

(1) See *R.*, January, 1918, No. 93. (*Ed.*)



1034 — **The Influence of the Vegetable Function of Yeast on the Yield of Alcohol; a New Interpretation of Fermenting Power.** — LINDET, L., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 22, pp. 910-913. Paris, June 3, 1918.

In a previous paper (1) the author had shown that, during alcoholic fermentation, yeast splits up the sugar it destroys into two parts: — 1) that part corresponding to the formation of the cells, to the production of glycerine, succinic acid, and carbonic acid corresponding to the respiration of these cells, etc.; this part he called "fermentation residue" but now calls "vegetable function part"; 2) that part which gives rise to the alcohol and carbonic acid corresponding to the breaking-up of the sugar (GAY-LUSSAC's formula), which is the "zymatic function part".

The results are given of new experiments in which yeast was subjected to anaerobic conditions. The influence of the food value of broth, that of the sugar concentration, of the more or less plasmolysed globules, and of the temperature of fermentation were studied.

The less yeast there is, the longer does fermentation last; the higher the proportion of sugar consumed by the vegetable function, the lower the yield in alcohol. In the experiments lowering the temperature had more influence on the duration of fermentation than on the reduction in weight of the yeast. This also holds good when the amount of yeast is increased. When a certain limit (1 in 1000 of dry yeast) is exceeded, fermentation is very rapid, but the maintenance and respiration of an excessive number of cells causes too great a consumption of sugar for the vegetable function. The origin of the yeast does not appear to influence the yield.

The fermenting power must be considered to lie in the two functions of the yeast; the amount of sugar consumed by a yeast unit for its vegetable life should be called *vegetable power*, that consumed to accomplish its zymatic function should be called *zymase power*; the total of these two represents PASTEUR's fermenting power. In the experiments these two powers proved higher in proportion as the yeast gathered was less and fermentation continued longer. This prolongation of vegetable life, accumulating more residue, formed a larger quantity of zymase.

If these two powers, especially the vegetable power, are compared with a unit of time (24 hours), it is seen that, except when lowering the temperature hinders respiration, the weight of sugar yeast utilises to form a given weight of yeast in a given time, is practically the same under the various conditions of the experiment.

1035 — **Decortication of Wheat Previous to Milling.** — LINDET, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 10, pp. 569-573. Paris, May 20, 1918.

The attention of the Ministry of Agriculture and Food Supply has been drawn to a method by which wheat may be decorticated previous to milling so that only the kernel remains to be ground. The wheat is moistened with a small quantity of water in an Archimedian screw which conducts it to the decorticator, composed of two plates with radiating grooves.

(1) See R. Dec., 1917, No. 1218. (Ed.)

One of these plates is fixed; the other revolves in front of the first at the rate of 300 revolutions.

A commission was appointed to examine this method and the author (professor at the "Institut National Agronomique"), who was a member of it, gives the results of the experiment.

All the results were negative. The apparatus removed only the pericarp, leaving the other three coats (seminal tegument, hyaline layer and protein cells) which are the most important. The wheat thus decorticated gave less flour, and even less bran, than the control wheat, the loss being about 2.49 % instead of 1.10 %, the normal figure. The bran of the wheat treated by the new process contained more adhering flour, the flour less gluten, and the bread made from it was brown and tasted of bran, *i. e.*, had the taste of all bread made with wet wheat. The skins which come from the apparatus as paste are not saleable.

The author concludes that this method and all others based on the same principle can give no satisfactory result.

1036 - Oil of *Pistacia Lentiscus* — *The Cyprus Agricultural Journal*, Vol. XIII, Pt. 2, pp. 28-29. Nicosia, April, 1918.

In Cyprus an edible oil (shinia oil) is extracted from the fruit of *Pistacia Lentiscus*, a plant which grows wild throughout the island. Although the consumption of this oil has increased greatly of late years its preparation only constitutes a small industry of the poor classes, who manufacture it for domestic use, and but little for commerce. The yield is about 18 %. Owing to the primitive methods of preparation it rarely keeps more than three months without turning rancid.

1037 - Experiments on the Biological Saponification of Various Fats from the French Colonies. — HEM, F., in the *Bulletin de l'Office colonial*, Year XI, No. 124, pp. 227-231. Melun, April, 1918.

The biological saponification of fats causes them to break up into fatty acids and glycerine under the influence of a special soluble ferment. The soluble saponifying ferments must occur in all oily seeds at the time of their germination; their action alone allows the embryo to utilise, after saponification, the oil reserves of the seed. Indeed, at the moment of germination of various fatty seeds it has been possible to determine a more or less considerable increase in the amount of free fatty acids. This breaking-up (hydrolysis) of the fat normally occurs *in vivo*; for some unknown reason it is difficult to reproduce it *in vitro*.

The soluble ferment of the castor oil seed is the only one it has been possible to isolate and make act on a certain number of fats to cause saponification. Very pure products (fatty acids and glycerine) were obtained, and the method has been adopted commercially.

The Department for the study of colonial products has studied the fats capable of being split-up and treated with castor oil ferment without having to be subjected to the different operations required for aqueous acid or alkaline saponification. The only fats on which castor oil ferment had any notable action under the experimental conditions adopted, were

oil of cotton, tea, the pericarp of aouara, the kernel of aouara, *Funtumia elastica*, *Carapa microcarpa*, *Sorindeia olessa*, and *Chrysophyllum congoense*. The fermentation action was negligible for the other fats examined, and before and after the action the proportions of acidity were either very similar or identical.

As a rule the proportion of acids formed is fairly low, and, with the exception of *Carapa microcarpa*, is rarely above the 80 or 90 % which has sometimes been found in saponification with castor oil. This may be due to the relatively high temperature at which the fermentation tests were carried out — 37 to 38° C., when the optimum temperature is about 30°. This higher temperature was indispensable to maintain the fat in the liquid condition essential to the normal progress of fermentation.

The initial acidity of the oils of the pericarp of aouara and *Chrysophyllum congoense* seems to show them to contain a saponifying ferment. The subsequent commercial utilisation of the ferments contained in the various oily seeds calls for a long series of successive studies.

1098 - **The Utilisation of Paddy in Italy at the Present Day** (1). — NOVELLI, N., in *Il Giornale di Risicoltura*, Year VIII, No. 4, pp. 49-52, Vercelli, April 30, 1918.

Before the war paddy supplied in Italy numerous commercial varieties of rice representing as many different stages of the preparation of rice often in connection with the variety of paddy. There were varieties "mercantile" (commercial), "raffinato" (bleached), "camolino" (polished), "oleato" (polished with oil), "brillato" or "francesino" or "diamante" (coated) etc. (2). The forms representing the last stages of preparation were originally intended for exportation (which exceeded  $\frac{2}{5}$  of the production) for which rice which would keep during voyages and in hot countries was indispensable. Later they were used for local consumption, either because Italians preferred them to other varieties, or because dealers, by polishing, could better hide certain natural defects.

As is known, complete polishing reduces the yield of rice by as much as 50 % in some cases, and deprives the seed of the outer layers which are the richest in fats, albuminoids and phosphorus. In order to obtain the highest possible yield and the best food value from rice the "Commissariato generale dei Consumi" (General Food Commissariat) therefore ordered the standardisation of the different types of prepared rice, so that at the present time only one type is produced. This is neither polished with oil nor scoured and represents the commercial type, which follows on rice which is merely husked ("sbamato"). A slight percentage of small or pointed seed ("mezzagrana") is also left in this rice. The proposal to reduce the preparation of rice to the husked type has been given up because it always contains numerous silicious fragments derived from the husk and is more difficult to keep. About  $\frac{4}{5}$  of the total number of the different varieties of rice grown in Italy are of Asiatic origin, very resistant to disease, and very productive. For this very reason they have a longer vegetative period and consequently are not always entirely physiologically ripe, with the result

(1) See also *R.*, August 1918, No. 906. — (2) For these terms see *R.* October, 1917, No. 933. (Ed.)

that their seeds are richer in moisture. Such rice when simply husked will not, therefore, keep long.

From a point of view of their keeping qualities husked Italian rices are not equal to husked Hindoo rices, which are perfectly ripe physiologically and naturally dry. On the other hand they contain about 20% of seed with glumes which lessen fermentation but make it necessary to re-treat the imported rices to remove these glumes.

About  $\frac{4}{5}$  of the rice requisitioned in Italy at the present time gives a yield of 67 to 70 %. The small or pointed seeds ("mezzegrane"), broken rice mixed with weed seeds ("risetto") and broken rice ("pistino") are ground into flour for bread; the coarse flour ("farinaccio") is used for bread-making and the residue, sometimes mixed with that of various products, is used for preparing dressing for fabrics. The residue containing fragments too adulterated with seeds of weeds is sold to breweries, and the residue of decorticated rice ("pula") is used as a food for cattle. Investigations into the best methods of utilising the residue of decortication for the making of bread and other foodstuffs are now in progress.

1039 - **Drying Vegetables.** — VERMOREL, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 20, p. 613. Paris, June 5, 1918.

The author emphasises the importance of the problem of drying vegetables; and points out that the temperature in nearly all the methods adopted is from 70 to 80°C. To avoid coagulation of the albuminoids the temperature should not exceed 40 to 42°C., or the dried vegetables become so hard that they are unfit for consumption.

1040 - **"Gelso-lino" (Mulberry Flax), in Italy.** — SANSONE, A., in the *Bollettino dell'Associazione dell'Industria Lombara Italiana*, Year XXXII, No. 5, pp. 52-54. Biella, May 31, 1918.

Some 50 years ago a small manufactory was founded in Bergamo for making strong, resistant paper, imitating the Chinese and Japanese varieties, and using mulberry fibre; the factory, however, did not last long. Besides this the author recalls work done in his manufactory at Vittorio Veneto (Province of Treviso) by PASQUALIS, who found a method for isolating mulberry fibre, which he called "gelso-lino", for use in spinning and weaving. The author describes his full scale experiments carried out in 1906 at the works of the "Unione Concimi e Prodotti Chimici" at Bovisio, near Milan. These experiments showed that the most practical method for separating the fibre in the mulberry branches (loppings) was as follows:— Soak the branches in pools or ditches (not necessary if wood is green); crush the retted or green branches with a heavy roller on a cement, wood or tiled floor; collect the bark thus separated; crush the wet bark mechanically to separate the epidermis, which is easily powdered; sieve in a metal mesh cylinder, the fibre remaining inside, the impurities passing through the meshes; bleach with alkalis and acids, and then with a hypochlorite solution. The author carried out these experiments with the idea of finding whether mulberry fibre could be used as a cheaper substitute for jute for making sacking. Owing to the low price of jute at that time, the results were negative. However, mulberry fibre, freed

from its gummy matter and bleached, can give products of much greater value than jute. At Vittorio Veneto, PASQUALIS made pure "gelso-lino" textiles. The author advises that it should be treated to obtain more even fibres, although they are shorter, then carded; the longest fibres should be mixed with cotton, spinning wool, or hat felt while the shortest should be used as a water-absorbent. "Gelso-lino" alone or mixed with wool or cotton dyes perfectly. Two-shade effects can be obtained in the mixed tissues by means of the acid-dyes used for wool. The short fibre can be used in paper-making to strengthen paper made with inferior material. The yield of bleached fibre is from 10 to 20 % of the dry bark, i.e., 2 to 5 % of the weight of branches treated.

The author points out that there are from 100 to 150 million mulberry trees in Italy. If each tree gives loppings with 100 to 150 gm. of fibre, an annual production of 15 million kg. of "gelso-lino" would be possible. The system of growing mulberry trees high, common in Italy, is not the best for fibre production. To obtain the long, uniform branches best suited for the industry, the mulberry should be grown with a low trunk as in the method usual in Japan but rare in Italy.

1041 - **The Manufacture of Paper Pulp from Dead Leaves.** — BRAMSON, K., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLVI, No. 21, pp. 853-854. Paris, May 27, 1918.

Each year in France there are from 35 to 40 million metric tons of dead leaves. To meet the country's paper requirement only 4 million tons would be necessary, which would, moreover, yield 2 million tons of useful by-products. It is easy to collect the leaves, and as they may be utilised throughout the year it is not necessary to store them. They could be transported in compressed form, but it would be better to instal works on the outskirts of the large forests where the raw material could be collected as required.

The process for making paper pulp from leaves is simple, rapid, and inexpensive. The leaves are crushed and then divided into two parts — the *veins* and *powder* (the blade falls into powder after crushing). The veins form the raw material for the pulp; they are steeped in lye for a short time, then washed and bleached, and the pulp is made.

The powder may be used as a fuel. It may be compressed into bricks with or without coal dust. Dry distillation is, however, preferable. By this method is obtained a relatively pure (porous) fuel, rich in calories (6 500 to 7 000), and easily agglomerated. At the same time are obtained a tar (which has all the properties of Norwegian tar), acetone, and pyroigneous acid. The powder may also be used as a food for cattle for, as the fibrous parts of the leaf have been removed, the assimilable, nutritive parts remain. The food value of this powder is almost equal to that of hay. Mixed with compressed molasses it gives a cake as good as that of hay.

The yield of 1 000 lb. of leaves is: — 1) 250 lb. of paper pulp; 2) 200 lb. of pure fuel (or 500 lb. of food powder); 3) 30 lb. of tar, 1 lb. of pyroigneous acid, 0.6 lb. of acetone.

1042 - **The Cotton Mill Industry of the World.**—*The Indian Textile Journal*, Vol. XXVII, No. 319, p. 221. Bombay, April, 1917.

The consumption of cotton in the various countries of the world and the member of spindles in active use during the years 1901 and 1916 are given in the following table:—

	Cotton consumption Bales of 500 pounds gross Season of 1915-1916	Cotton spindles	
		1901	1916
United Kingdom . . . . .	4 120 000	46 400 000	56 400 000
United States . . . . .	7 325 000	20 800 000	33 000 000
Germany . . . . .	800 000	8 140 000	11 750 000
Russia . . . . .	2 070 000	7 900 000	9 100 000
France . . . . .	1 025 000	5 700 000	7 300 000
India . . . . .	2 040 000	5 000 000	6 850 000
Italy . . . . .	900 000	2 000 000	5 000 000
Austria-Hungary . . . . .	390 000	3 500 000	4 950 000
Spain . . . . .	400 000	1 800 000	3 200 000
Japan . . . . .	1 670 000	1 250 000	2 900 000
Brazil . . . . .	325 000	400 000	1 500 000
Switzerland . . . . .	90 000	1 300 000	1 500 000
China . . . . .	2 525 000	200 000	1 250 000
Belgium . . . . .	20 000	920 000	1 100 000
Canada . . . . .	225 000	600 000	975 000
Scandinavia . . . . .	160 000	400 000	850 000
Mexico . . . . .	85 000	300 000	550 000
Holland . . . . .	100 000	350 000	545 000
Portugal . . . . .	60 000	230 000	480 000
Other countries . . . . .	161 000	220 000	585 000
Total . . . . .	24 500 000	107 395 000	149 785 000

1043 - **The Carbonisation and Distillation of Peat, Wood-shavings, Household Waste and Other Light Organic Products.**—GALAINÉ, C. and HOULBERT, C., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLVI, No. 21, pp. 851-856. Paris, May 27, 1918.

Even when after the war coal-mining again becomes normal in all countries, the peat-industry will have a great future before it because this product is less important as fuel than for the distillation of the peat itself or of the "tourbon" (1) as a substitute for wood in the manufacture of acetic acid, methyl alcohol, ammonia and tar, which forms the basis of so many colouring matters.

With very dense matter, such as coal, small, rectangular, elliptical, relatively narrow retorts can be used, but for peat, or light products, it is

(1) "Mr. Eckenberg of London has shown that peat heated under pressure at a temperature above 150°C. loses its gelatinous consistency and can be easily dried by compression. For purely technical reasons it has not hitherto been possible to apply ECKENBERG'S method industrially. Nevertheless the product obtained therefrom has very interesting properties: it is no longer peat, but a new substance to which we give the name "tourbon". (GALAINÉ, LÉONORMAND and HOULBERT, Sur l'exploitation économique des tourbes de Châteauneuf-sur-Rance (Ille-et-Vilaine), in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 10, p. 337. Paris, Sept. 3, 1917). (Ed.)

necessary to use a large retort which will allow a more easy transmission of the heat from the periphery towards the centre. From their experiments the authors concluded that the best results were obtained with a revolving retort. They describe their apparatus which is constructed on the principle of roasters for organic matter (coffee, cacao, chicory, etc.), and is fitted with a recipient for collecting the distillation gases. The apparatus has three characteristic peculiarities:— 1) revolving retorts which successively bring the substances to be carbonised into contact with the heated wall; 2) perfectly continuous working; 3) easy emptying and charging with fractional separation of the distillation products.

The apparatus may also be used for the carbonisation and distillation of wood, lignite, saw-mill waste, household waste, and all more or less completely dry organic residues.

1044 - **The Four Essential Factors in the Production of Milk of Low Bacterial Content.**

— AYERS, S. H., COOK, L. B. and CLEMMER, P. W. (Dairy Division of the U. S. Department of Agriculture), in the *U. S. Department of Agriculture, Bulletin No. 642*, pp. 61 + 28 Tables + 23 Figures + 6 Plates + Bibliography of 47 Publications. Washington, April, 1918.

This paper is a new contribution to the hygienic factors influencing the bacterial content of milk. The authors wished to confirm once more the necessity of observing the well-known sanitary rules (1) by supporting them by indisputable scientific data. They made several bacterial counts of milk taken under the following conditions:— 1) sterilised utensils; 2) clean cows with clean udders and teats; 3) small-top pail.

The following data taken from the numerous tables given in the bulletin show the degree to which the cleanliness of milk is to be attributed to the observation of these principles.

1) **STERILISED UTENSILS.** — This is the factor with the greatest influence on the bacterial content of milk. Counts made from 60 samples of milk showed an average of 6 306 bacteria per cc. when the utensils were sterilised and 73 308 when they were not sterilised; the difference (67 002 bacteria) can, thus, only be attributed to the sterilisation of the utensils.

2) **WASHING THE UDDER AND TEATS.** — When the animals and barn were kept clean the bacterial counts per cc. of 65 milk samples gave the following figures:— 1) *udder and teats washed*, minimum 620 bacteria, maximum 5 400, average 2 154; 2) *udder and teats unwashed*, minimum 1 050, maximum 20 400, average 4 524.

3) **SMALL-TOP PAIL.** — The small top pail is of the ordinary type with a fixed top leaving only a small semi-circular opening near the edge. Throughout the experiment milk taken in this pail always had a much lower bacterial content than that taken in an ordinary open milking-pail whatever the other conditions were. The maximum number of bacteria per cc. in the first case was 750 000, in the second, 1 200 000.

In order the better to control their results the authors combined the various factors in different ways. Data on the contamination of milk by faeces are also given.

(1) See *R.*, May, 1917, Nos. 483 and 485. — *R.* January, 1918, No. 71. (*Ed.*)

Finally, the *effect of temperature* on the bacterial content of milk was observed. Counts were made of fresh milk kept at 4.4°, 10°, and 15.5° C. and 21.1° C. for 24 hours and 4 days. At the end of 96 hours the figures for the bacterial growth in all the samples tended to resemble each other. The optimum temperature is 10° C. or less.

The authors believe the three factors considered and the keeping of the milk at a temperature near 10° C to be the most essential conditions for the production of fresh milk with a low bacterial content, and that too much attention has often been given to other, less important factors. Moreover, these conditions may easily be observed, even in medium-sized dairies.

1045 - **The Enzymes of Milk and Butter.** — THATCHER, R. W. (Minnesota Agricultural Experiment Station) and DAHLBERG, A. C. (Wisconsin Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No. 9, pp. 437-450 + Bibliography of 27 Publications. Washington, November, 1917.

The deterioration of butter during storage is often attributed to the enzymes in the buttermilk which it contains. Most investigations into the matter give little information as they chiefly deal with the chemical changes in the butter itself during storage and not its enzyme content. The following types of enzymes have been reported to be normally present in cow's milk: — an amylase, a lipase, proteases, a peroxidase, salivase, catalase, reductase, a lactose-fermenting enzyme. These results are not always in agreement.

During the summer of 1915, DAHLBERG prepared several lots of butter under carefully controlled conditions of manufacture and placed them in storage, in order to study the effect of varying methods of manufacture. He also studied the bacterial development in these butters (1). This excellent material was ready for a study of the enzyme content of the butter after storage, and such a study was undertaken by the authors, the results being given below.

**RESULTS.** — Proteolysis in skim milk was completely inhibited by 1 % of chloroform and by 15 % of sodium chloride. Galactase (the normal proteolytic enzyme of milk, which aids in the slow decomposition of milk proteins into peptones, amino acids and ammonia) cannot act in normal butter because of the high salt content.

In the separation of milk the factors which increased the percentage of casein in the total nitrogen also increased the galactase content. The ripening of cream did not increase the rate of proteolysis. No oxidase was found in milk or butter. Only one sample of butter out of 8 gave any evidence of lipase at the end of 4 days at 40° C. The enzyme content of butter is very small, because of the high dilution in fat. Expressed on the basis of total nitrogen the butter examined contained as much galactase as fresh whole milk, twice as much catalase, but only one hundred and sixtieth as much peroxidase. The cold storage of butter weakens the per-

(1) See WASHBURN, R. M. and DAHLBERG, A. C., The Influence of Salt on the Changes taking place in Storage Butter, *Journal of Dairy Science*, Vol. II, No. 2, pp. 114-126, 1917 (*Id.*).



oxidases, but has little effect on the catalase and galactase. Enzymes are present in butter in such small amounts and under such unfavourable conditions for enzyme activity during cold storage that they need not be considered as a factor in the deterioration of butter during storage.

1046 - **The Deterioration of Condensed Milk; Estimation of its Acidity.** — DUGARDIN, M., in *Annales de Chimie Analytique*, Vol. XXIII, No. 4, pp. 83-84 + 1 Table. Paris, April, 1918.

The present large demand for condensed milk has resulted in its being manufactured with increasing rapidity. If, however, sterilisation is imperfect the milk easily undergoes a fermentation which makes it unfit for consumption. To determine this deterioration it is sufficient to estimate the acidity.

The author estimated the acidity in several samples of condensed milk of different brands. The method used was as follows: — 10 gm. of the sample are diluted in 25 cc. of tepid, distilled water (from which the  $\text{CO}_2$  has been previously removed by boiling); titration with a decinormal solution of caustic soda, using phenolphthalein as an indicator; the acidity is expressed as lactic acid per 100 gm. of matter. The results showed that the normal acidity for sweetened unskimmed milks and for sweetened skimmed milks does not exceed 0.5 gm. An acidity between 0.5 and 0.75 gm. shows a deteriorated milk. Milk with an acidity above 0.75 gm. is unfit for consumption. In this last case the boxes bulge out very much, and the contents are violently expelled when they are opened. Unsweetened milks become clotted and are difficult to dissolve in water. Sweetened milks are solid and give off a disagreeable smell.

1047 - **Bacterial Precipitins and the Detection of *Bact. botulinus* in Preserved Foods by the Thermo-Precipitation Method.** — BORNAND, M. (University of Lausanne and the Cantonal Laboratory of the Sanitary Service), in *Travaux de chimie alimentaire et d'hygiène publiés par le Service suisse de l'hygiène publique*, Vol. IX, Pt. 2 and 3, pp. 87-98. Berne, 1918.

The author reviews the work on *precipitins*, first observed in 1897 by KRAUS, who found that a typhus or cholera anti-serum in the presence of the filtrate of a homologous culture causes a precipitate. As the precipitation reaction was nearly always specific, work on the precipitins has given rise to their being put to various uses: — 1) particularly in the analysis of foodstuffs anti-serums have been prepared for identifying eggs and milk in products said to contain them; 2) in the control of meats and the determination of their nature, e. g., CLARKE (*Bull. Pasteur*, p. 731, 1914) was able to prove that meat sold in an hotel as bear's meat was in reality meat of a deer, the hunting of which was prohibited; 3) in medical diagnosis: — parasitical diseases (echinococcosis, Leishmaniosis, dourine, etc.); bacterial diseases (glanders, cerebro-spinal meningitis, human and bovine tuberculosis, etc.).

**ASCOLI METHOD.** — ASCOLI and VALENTI discovered that bacterial precipitogens are very resistant to heat and adapted this knowledge to a new method for the diagnosis of bacterial infections called by them the *thermo-precipitin* method; e. g., in the diagnosis of anthrax a few grams of the ma-

terial believed to be infected are placed with the physiological solution in a test tube which is left from 3 to 5 minutes in a boiling water bath. After cooling and filtering the clear liquid is placed in contact with the precipitating serum, and if the material examined is infected, a white ring is formed at the point of contact of the two liquids. Putrefaction, which impedes the search for the bacterium in direct examination, has no action in this case; thus the precipitation reaction was still positive for an infected cow, the dead body of which had been buried at a depth of about 6 1/2 feet for 45 days and had been sprayed with paraffin, and also for organs kept in alcohol for 4 months.

Control experiments showed the reaction to be specific. The ASCOLI method the value of which is recognised, has been used for the diagnosis of swine plague, tuberculosis, Malta fever, paratyphous infections, etc.

DETECTION OF *B. botulinus* IN PRESERVED FOODS. — The author wished to determine if the immunisation of a rabbit with extracts of *Bact. botulinus* would make it possible to obtain a precipitating anti-serum for this organism, and if it could be detected in preserved food by thermoprecipitation. He immunised a rabbit by sub-cutaneous inoculations in both thighs made at intervals of 3 or 4 days with extracts of a culture of the bacterium. Eight days after the last injection the animal was bled, part of the serum filtered and the other preserved with toluene. A precipitating anti-serum specific for this bacterium at ordinary temperature was thus obtained.

Taking advantage of the thermo-stability of the precipitogen the author attempted to identify the presence of the organism in question in artificially infected preserved foods: — 3 boxes of braised beef, 1 box of herrings and 1 box of peas. At the end of 5 months the lids of all the boxes except that of peas bulged considerably. When opened gases with a butyric smell were given off. A microscopical examination and cultures made from the contents of the boxes showed the presence of *Bact. botulinus*. Five grams of the contents were then treated in physiological solution by the ASCOLI method. (The filtered anti-serum has a weaker precipitating action than that kept in toluene). The results of the reactions thus produced at room temperature may be summarised as follows: — anti-serum + extract of *Bact. botulinus* culture gave a precipitate after 30 minutes; anti-serum + extract of normal preserved braised beef, no precipitation; anti-serum + extract of infected preserved braised beef and infected preserved herrings, precipitation after 60 minutes; anti-serum + extract of preserved peas, no precipitation.

It is seen that the reaction is negative with preserved vegetables (peas).

CONCLUSIONS. — 1) By injecting rabbits subcutaneously with extracts of a culture of *Bact. botulinus*, a precipitating anti-serum of this bacterium may be obtained.

2) The presence of *Bact. botulinus* may be detected in preserved meat by the ASCOLI method as a result of the thermo-stability of the precipitogen of this bacterium.

## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1048 - **Researches on Apple-Spot Diseases.** — BROOKS, C. and FISHER, D. F. (Bureau of Plant Industry, U. S. Department of Agriculture), in *The Journal of Agricultural Research*, Vol. XII, No. 3, pp. 109-137 + 10 Figs. + 4 Plates + Bibliography of 22 Publications. Washington, January 21, 1918.

The present paper deals with the effects of soil-water supply upon bitter-pit, Jonathan-spot and certain other non-parasitic spot diseases of the apple (*Malus sylvestris*). It also includes notes upon the relation of the time of picking to the development of apple-spots in storage. The authors' summary of the results is given below.

1) Bitter-pit and Jonathan-spot are to be distinguished from rosy-aphis stigmomose, drouthspot, cork, blister. Bitter-pit usually appears first as spots of dead, brown tissue in the sub-epidermal portion of the apple. These spots are associated with the terminal branches of the vascular bundles and in later stages of the disease the browning often follows the vasculars deep into the flesh of the apple. Rosy-aphis stigmomose is characterised by similar brown spots in the sub-epidermal region but the affected tissue is firmer than in the case of bitter-pit and there is no association with the vascular bundles. The early stages of Jonathan-spot are confined to the colour-bearing cells of the skin of the apple. Drouthspot is characterised by the checking of the growth at certain points on the apple without the production of any large quantity of corky tissue; fairly large areas of dead brown tissue usually occur near the surface of the apple, but sometimes are to be found deeper in the flesh; the spots are usually located in the blossom half of the fruit, which appears to be more susceptible after it is some one-third grown. Cork differs from the drouthspot in the presence of comparatively large spots of brown corky tissue, and in the fact that these are usually rather deeply seated in the flesh of the apple. Blister is a superficial lesion associated with cork and characterised by its blister-like appearance.

2) Drouthspot was produced by sudden and extreme drouth. It occurred on trees that were favourably located as well as on those that were growing under rather unfavourable soil conditions. Cork is apparently also a drouth effect, but it differs from drouthspot in the fact that its occurrence is usually associated with certain peculiar soil types.

3) Experiments have shown that there is a close relationship between

the soil-water supply of the orchard and the development of bitter-pit in storage. Heavy irrigation greatly increased the disease, but not so much as medium irrigation followed by heavy irrigation. Light irrigation greatly reduced it, but heavy irrigation followed by light resulted in the lowest percentage of the disease. Sudden changes in the amount of soil-water apparently did not increase the disease.

4) Heavy irrigation may have been slightly favourable to the development of Jonathan-spot, but the contrasts were too slight to justify definite conclusions.

5) Large apples showed greater susceptibility to bitter-pit than small ones, but with Jonathan apples heavy irrigation increased the disease on the medium-sized fruit as well as on the large, and with Grimes the percentage of increase from heavy irrigation was even greater on small apples than on large ones. Apparently, large apples are not susceptible to bitter-pit merely because they are large, but rather because of certain conditions under which they become large.

6) In 1915 there was more Jonathan-spot on the large apples than on the small ones, but in 1916 there seemed to be no correlation between size of fruit and severity of disease.

7) During the first weeks of cellar storage more Jonathan-spot developed on apples that were picked early than on apples that were picked late, but with longer periods of storage these contrasts seemed to largely disappear. The results indicate, however, a greater susceptibility in the early-picked fruit.

8) Bitter-pit was worse on the Jonathan apples that were picked early than on those that were picked late.

1049 - The Injurious Action of Magnesium Carbonate on Plants. — See No. 969 of this Review.

#### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

1050 - The Morphology and Biology of *Blepharospora cambivora*, an Agent of the "Ink Disease" of the Chestnut (1). — PETRI, L., in the *Annali del R. Istituto superiore forestale nazionale*, Vol. III, pp. 3-34 of the Reprint + 8 Figs + 1 Plate. Florence, 1918.

The mycelium that kills the cambium and which constitutes the specific agent (*Blepharospora cambivora* Petri) of the disease should be classed with the order *Saprolegniineae* of Schröter. It is characterised by an abundant development of multicellular hyphae on dead organic matter as well as by the formation of lemonshaped, isolated, terminal sporangia that produce zoospores or non-motile spores. The formation of spheroidal oospores with smooth walls takes place in the terminal oogonia fertilised by the filamentous antheridia.

The spores germinate in the water of the soil humus of the chestnut

(1) See R., March, 1918, No. 361 (Ed.)

wood or in that of streams into which the mycelium may be washed. In artificial culture the spores were germinated in drinking water or in very dilute solutions of nutritive mineral salts. Up to the present the formation of oospores has only been observed in the infected tissues of young, germinating plants. The presence of soluble carbohydrates and nitrogenous compounds hinders the formation of sporangia, while it favours the purely vegetative growth of the mycelium. The presence of calcium oxide not only inhibits the formation of spores, but also hinders the growth of the mycelium.

The dissemination of the parasite in the same chestnut wood or over a relatively limited area is chiefly due to rain water running over the ground and into the brooks.

The mycelium and the motile and non-motile spores cannot resist drying.

Dissemination by the wind only takes place in the case of the oospores. Chestnut woods should, therefore, be very closely watched, as it is chiefly from them that the durable germs of the parasite spread in large numbers and to a great distance. Infection does not take place through the direct attack of the germination tube of the spore, but always after the mycelium produced by a spore has developed saprophytically in contact with the receptive organ.

Artificial infection tests have shown that the parasite may attack germinating young plants as well as subjects of all ages, but only in the subterranean organs or in the basal portion of the stem. The great ease with which the disease was reproduced artificially shows that the effect of eventual conditions favouring receptivity can rightly be considered as negligible in the etiological study of the disease.

A damp and mild winter and spring constitute the principal conditions favouring the appearance of the disease, given that they are essential factors for the development of the parasite.

The parasitic action of *Bl. cambivora* can be considered as specific, as the fungus has been found to be unable to attack other Cupuliferae.

1051 - **The Resistance of Manitoba Wheat to Fungous Diseases** (1). — SCHRIBAUX, in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. IV, No. 17, pp. 530-532. Paris, 1918.

In the spring of 1917, "Manitoba" and "Aurore" wheats were sown at the Grignon School of Agriculture by the side of "Japhet", "Bon Fermier" and "Saumur de printemps" for the purpose of studying their comparative resistance to fungous diseases.

The results are interesting, showing the superiority as regards their resistance to smut of the alternative wheats (Japhet and Bon Fermier) over the spring wheats (Saumur de printemps and Aurore) which, before Manitoba was introduced, were usually grown at the School. Thus, for 3 smutted ears of Bon Fermier and 16 of Japhet, sown on March 16, 1917, there were no less than 74 for Saumur de printemps.

(1) See R., January 1918, No 34. (Ed.)

For the same wheat the number of smutted ears increases as the sowing date gets later. Thus Saumur de printemps, sown on March 16, gave 74 smutted ears and when sown in the same soil a month later, on April 14 gave 157 or more than double.

Manitoba is remarkably resistant to smut and to fungous diseases in general. In the experiments in question, not a single smutted ear was seen either in the plots sown early (March 16) or in those sown late (April 26).

The author concludes that Manitoba wheat will probably be of great value to plant breeders for the creation of new wheats resistant to fungous diseases.

1052 — **Patents for the Control of Diseases and Pests of Plants.** — See No. 1030 of this Review.

1053 — **Cereal Mildew (*Sclerospora macrospora*) observed on Maize, in Piedmont (1), Italy.** — GABOTTO, L., in *Il Coltivatore*, Year LXIV, No. 16, pp. 331-333 + 3 Figs. Casale Monferrato, 1918.

In 1917, in a plot containing about 300 plants of maize, the author found about 60 plants attacked by *Sclerospora macrospora* Sacc. The diseased plants — with a weakly general appearance — had virescent male flowers and no ears.

The author advises that infected plants should be burnt to prevent the spread of the disease, and a watch kept for freshly diseased plants.

1054 — **Smuts Injurious to Sorghum in the Presidency of Bombay.** — KULKARNI, G. S. in the *Agricultural Research Institute, Pusa*, Bulletin No. 78, pp. 1-16 + 6 Plates. Calcutta 1918.

The word "Jowar", as used in the Bombay Presidency, indicates all the cultivated varieties of *Andropogon Sorghum* Brot. (= *Sorghum vulgare* Pers.), which takes the first place among cultivated crops in the Presidency. Jowar is so largely grown an account of its two-fold use as food and fodder.

The number of fungous diseases affecting this crop is large, but by far the most important of them from the economic point of view are those that cause the well-known smut disease. In the Bombay Presidency 4 smuts have been found attacking sorghum; these are —

1) *Sphacelotheca Sorghi* (Link) Clinton, occurring throughout the Presidency; known as "grain smut";

2) *Sph. cruenta* (Külm) Pot., in the Sholapur district; known as "loose smut";

3) *Tolyposporium filiferum* Busse, in Sind; known as "long smut".

4) *Sorosporium Reilianum* (Külm) Mc Alpine, sporadically, throughout the Presidency; known as "whole-head smut".

The virulence and distribution of the disease seems to depend largely upon the freedom or otherwise from contamination of seed with spores previous to sowing. In general, localities with high rainfall have more smut

(1) See *R.*, April 1917, No. 381; *R.*, Sept. 1917, No. 872; *R.*, April 1918, No. 477. (Ed.)

than those with low rainfall. It has also been found that the varieties of sorghum called Kharif (the monsoon crop, sown in June-July and harvested in October-November) are more attacked than those called Rabi (the winter crop, sown in September-October and harvested in February-March). However, loose smut (*Sph. cruenta*) is more common on the Rabi varieties in the Sholapur district.

The intensity of the damage caused by these smuts varies from year to year and even from field to field in the same locality. Thus the loss may be from 2 to 3 % for mild attacks up to 40 or 50 % for severe ones.

The deformation of the inflorescence resulting from the attack of each of the smuts is described as well as the characteristics and germination of the spores.

The author's observations confirm those of previous authors, which have shown that infection in the grain and loose smuts takes place at the seedling stage through the seed-borne spores.

As regards whole-head smut (*Sor. Reilianum*), the plant appears to be chiefly infected through the soil. In the long smut (*Toly. filiferum*) whose life-history is not known, it still remains to be ascertained whether infection takes place through the flower or through the spores in the soil from the previous crop.

The best preventive measure against *Sph. Sorghi* and *Sph. cruenta* is to treat the seed with copper sulphate solution, thus providing an easy, quick and cheap method. It was found that the seed can be dipped into a copper sulphate solution for 10 minutes, even at 3 % strength without in any way injuring their germinating power, and that even a  $\frac{1}{2}$  % solution acting for 10 minutes is successful in preventing the appearance of the two smuts in question.

No preventive measure against *Toly. filiferum* can be advised, as its complete life-history is not known.

The copper sulphate treatment is now widely advocated by the Bombay Agricultural Department and is practised by the cultivators. In order to meet the demands of the cultivators for copper sulphate, small packets of copper sulphate, worth an anna, have been prepared for some years. Each packet contains sufficient material for treating seed for 4 acres and includes instructions for use printed in all the vernaculars of the Presidency.

1955 - *Bacillus Solanacearum* Injurious to *Ricinus* in U. S. A. (1). — SMITH, E. F. and GODFREY, G. H., in *Science*, New Series, Vol. XLVIII, No. 1228, pp. 42-43. Lancaster, Pa., July 12, 1918.

To the already considerable list of natural host plants of *Bacterium Solanacearum* (brown-rot of Solanaceæ) must now be added the castor oil plant (*Ricinus communis*), which has been seriously attacked by the fungus in various localities of Georgia and Florida.

The *Ricinus* plants wilt in various stages of growth, and often at an

(1) See *R.*, August, 1912, No. 1238 and *R.*, July, 1917, No. 680. (Ed.)

early one. Dwarfing is usually the first sign of the disease in the seedling plants.

By using a culture of the bacterium isolated from the castor oil plant the author was able to produce the disease in several plants known to be subject to *B. Solanacearum*.

Land on which any of the common Solanaceous plants have wilted should not be planted to *Ricinus*, unless it is known positively that the wilt was not of bacterial origin.

1056 - **The Danger of Burying Felled Coconut Trees Between Rows of Rubber Trees in the Federated Malay States.** — SORBY, F. W., in *The Agricultural Bulletin of the Federated Malay States*, Vol. VI, No. 6, p. 269. Kuala Lumpur, 1918.

Observations recently made on a large rubber estate have shown that the practice of burying felled coconut trees between rows of rubber trees, is very dangerous. The coconut trees, instead of being buried, must be split, dried and burned.

A part of the estate in question had originally been planted with coconuts. At a later date the coconuts were interplanted with rubber. About 3 or 4 years ago, the coconut trees were cut out and their trunks cut into lengths and buried in the middle of the spaces between the rows of rubber trees. In 1917 it was found that a large number of the rubber trees were dying or sickly. They were found to be suffering from root diseases, principally brown root disease, *Hymenochaete noxia*, and wet rot, *Poria hypolateritia*, either together or separately. In nearly every case it was found that a badly diseased and decaying root of each of the attacked trees ran back into one of the pits in which the coconuts had been buried. In some instances only the roots connecting with the pit had become diseased, and the disease had not reached the main root and collar. In such cases the infected roots were cut off and burnt, thus saving the trees. In other cases, however, the main root and collar were badly affected and the trees had to be taken out and burnt.

After this discovery all the pits were opened, and the decaying trunks were taken out, split up, dried and burnt. At the same time rubber roots in the pits were followed up and when diseased were removed and burnt. Indications of the presence of *Poria hypolateritia* were found on most of the decaying coconut trunks.

Heaps of dug-out coconut wood that had been drying for a few weeks also showed numerous fructifications of the fungus *Fomes lucidus*, a common saprophyte in the tropics that has been recorded as killing trees, which it attacks at the roots and collar.

It was evident that two of these fungi that were rotting the coconut trunks were *Hym. noxia* and *P. hypolateritia* and that these trunks were full of these fungi in an actively growing condition just about the time that the roots of the rubber trees had grown long enough to penetrate well into the mass of decaying material. It should be remembered that such decaying material contains moisture and that tree roots are definitely attracted by moisture.



1057 - Diseases of Sugar-Cane in Tropical and Subtropical America, especially the West Indies. — JOHNSTON, J. R. (in collaboration with ASHBY, S. F., BANCROFT, C. K., NOWELL, W., and STEVENSON, J. A.), in the *West Indian Bulletin*, Vol. XVI, No. 4, pp. 273-308 + 7 Plates. Bridgetown, 1918.

It has seemed desirable to publish, in brief form, and for the use of both investigators and planters, descriptions of common cane diseases and their causative fungi occurring in tropical and subtropical America.

The bulk of the data given in the paper was compiled by Mr. JOHNSTON when working on the subject during a residence of four years in Porto Rico, several years in Cuba and during studies in Santo Domingo and in the Southern United States, besides various visits to many parts of tropical America.

As it was considered specially desirable to make the records as complete, the cooperation of the following phytopathologists in the American Tropics was asked:— ASHBY (Jamaica), BANCROFT (British Guiana), NOWELL (West Indies), and STEVENSON (Porto Rico).

The description of the diseases is followed by notes on their prevention and cure (a whole chapter is devoted to the control of fungous diseases) and a long bibliography on the subject.

The following diseases are specially considered:—

- 1) *Bacterium vascularum* (gumming disease of sugar cane);
- 2) Humid gangrene or "Polvillo" a disease probably due to the above-mentioned bacterium;
- 3) *Trichosphaeria Sacchari*;
- 4) *Gnomonia Iliou* (stem rot or Iliou);
- 5) *Sphaerella Sacchari*;
- 6) *Eriosphaeria Sacchari* (red leaf-spot);
- 7) *Leptosphaeria Sacchari*;
- 8) *Thyridaria tarda*;
- 9) *Nectria Laurentiana*;
- 10) *Ustilago Sacchari* (smut);
- 11) *Hypochmus Sacchari* (thread blight);
- 12) *Olontha saccharicola*;
- 13) *O. Sacchari*;
- 14) *Marasmius Sacchari* (root disease);
- 15) *M. stenophyllus* (root disease);
- 16) *Schizophyllum album*;
- 17) *Laternia columnata*;
- 18) *Cytospora Sacchari*;
- 19) *Coniothyrium melasporium* and *Darlucia melaspora* = *Melanconium Sacchari* (rind fungus);
- 20) *Diplodia cacaoicola*;
- 21) *Colletotrichum falcatum*;
- 22) *Melanconium saccharinum*;
- 23) *Cephalosporium Sacchari* (wilt);
- 24) *Thielaviopsis paradoxa* (pine-apple disease);
- 25) *Cercospora longipes* (brown leaf-spot);

- 26) *C. vaginae* (red spot of leaf sheath);
- 27) *C. Kopkei* (yellow leaf-spot);
- 28) *Helminthosporium Sacchari* (eye leaf-spot);
- 29) *Sclerotium Rolfsii* (red rot of leaf-sheath);
- 30) *Himantia stellifera*;
- 31) Yellow stripe disease;
- 32) Top rot;
- 33) Sereh;
- 34) Mottling disease;
- 35) Wither-tip;
- 36) Chlorosis.

1058 — *Cercospora solanicola* and *Cercospora* sp., Fungi respectively injurious to Tobacco and Sesame in the State of Pernambuco, Brazil. — AVERNA, S. R., in *Secretaria da Agricultura, Commercio e Obras Publicas do Estado de Sao Paulo, Boletim de Agricultura*, Series XIX, No. 1, pp. 70-71. Sao-Paulo, 1918.

Tobacco leaves from the School of Agriculture of Socorro (Pernambuco) were found to be attacked by *Cercospora solanicola* Atk., a parasite already recorded in the State of Sao-Paulo, in 1913 and 1914 on some plants of *Nicotiana Tabacum*.

The disease is very serious as the numerous spots on the leaves render them almost worthless. The parasite usually attacks plants growing in damp, shady places. The various species and varieties of tobacco show varying degrees of resistance to the disease.

As anticyptogamic remedies, though efficacious, would sensibly affect the commercial value of the leaves, the author advises growers to limit themselves to the following measures:—

- 1) the choice of resistant species and varieties;
- 2) if the ground is too damp, it should be drained or used to grow other crops;
- 3) avoid planting too close so as to allow the free passage of air round the plants;
- 4) at the first sign of infection, all diseased leaves should be cut and burnt.

On the leaves of "gergelim" or sesame (*Sesamum indicum*), also from Socorro, were found spots, which, from the microscopical examination were attributed to a *Cercospora*. The plants should be carefully watched and it is advisable, on the first signs of the disease, to uproot and burn the infected plants at once.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

1059 — *Aphelinus boveili* n. sp. and *Metalaptus torquatus*, Hymenoptera Parasite on other insects. — MALENOTI, E., in "Redia", Pt. 1 and 2, pp. 77-92 + 1, Figs. Florence, 1918.

With the discovery of *Aphelinus boveili* n. sp., 8 Chalcidids are now known as parasites of the scale insect *Chrysomphalus dictyospermi* Morg (1).

(1) See *R.*, January, 1918, No. 118; *R.*, July, 1918, No. 828. (Ed.)

The author examined 5 females from Bridgetown (Barbadoes), sent by Prof. J. R. BOVELL, to whom the present species is dedicated.

A description is also given of another chalcid, *Metataptus torquatus*, Malen., which had already been mentioned in a previous note (1917). The description is based on: — 10 specimens hatched out on orange leaves placed under a bell-jar for the purpose of studying the parasites of *Chrys. dictyospermi*; 3 females and 1 male in material from Mandarano (province of Catania); and 2 females in material from Palermo. The author thinks, however, that this species is not a parasite of *Chrysomphalus*, as certain Psocidae and some very minute lepidopterous larvae were present of which, as with other species of *Mymaridae*, *Metataptus torquatus* might prove to be a true parasite.

1060 — *Casca luzonica* n. sp., a Hymenopteron Endophagous on the Scale-Insect *Schizaspis lobata*, in the Philippines. — MALENOTTE, E., in "Redia", Vol. XIII, Pt. 1 and 2, pp. 73-76 + 6 Figs. Florence, 1918.

A description of the chalcidid fly *Casca luzonica* n. sp., an endophagous parasite of *Schizaspis lobata* Cockerell and Robinson, based on 2 females found by the author in specimens of that scale-insect on leaves of *Ficus nota*, sent to the Royal Station of Agricultural Entomology at Florence by Prof. C. F. BAKER, of Los Baños (Luçon Isle, Philippines). The male of the new hymenopteron is as yet unknown.

Although the hymenopteron had not pierced a great number of scales, yet appreciable damage was done.

1061 — The Use of Bats in the Control of Insects especially Tortricidae, Injurious to Pine Woods (1). — JOLYET, A., in the *Revue des Eaux et Forêts*, Year XVI, Vol. LVI, No. 6, pp. 121-216. Paris, June 1, 1918.

On account of the damage suffered by French forests on account of the war, the author considers the possibility of invasions of injurious insects. Among those attacking pine woods, he fears *Evetria* (*Retinia*) *resinella*, *E. bouliana* Schiff. (pine-shoot tortrix moth) and *E. turionana* Hb. (pine-bud tortrix) the most. As bats destroy great numbers of these insects, the author proposes to breed these most useful Chiroptera or, rather, to encourage them to come to live near pine woods requiring protection. To do this it is sufficient to erect cots in the midst of the pine wood to serve as refuge during the day and where the bats can winter without suffering from the severe cold.

The author has devised a cot consisting of a wooden box with double walls (leaving an air space of about 1 in.) of cubical form with sides 3 ft. 3 in. long. The box is protected from the rain by a double roof of planks covered with tarred paper and projecting beyond the sides.

The space thus left between the box and the roof should be filled with hay to keep out the cold. On the side of the box facing east an opening 12 in. high and 8 in. broad should be cut. A slide moving up and down grooves will serve to shut or open the door, through which the bats will enter

(1) For the use of bats for the destruction of mosquitoes, see *R.*, August 1913, No. 903. (Ed.).

or leave the shelter. The slide should be so arranged that it can be opened and closed by pulling a string, as the box should be placed about 10 ft high on a wooden scaffold or on a small tower built of stones without mortar. Inside the box rods will serve as perches for the bats.

The author advises the choice of bats belonging to the family Vespertilionidae (gen. *Vesperugo*) which hibernate in barns, towers, hollow trees, rather than bats belonging to the genera *Rhinolophus*, *Synotis*, *Plecotus*, *Vespertilio*, which are sensitive to cold and hibernate in caves and underground places. The first mentioned stand the cold better, are hardier, and live more peaceably with other bats than the latter, and also take to the cots more easily. In the genus *Vesperugo*, the large *V. noctula* and *V. scrolianus* are of special interest. These attain a length (without the tail) of 3.1 and 2.7 in. respectively, the spread of the wings being 14.1 and even 16.5 in. for the first and 12.9 in. for the second. *V. noctula*, so common, is particularly suitable on account of its size, its rapid, high flight and because it leaves its hiding place at night fall. The author also remarks upon *V. pipistrellus* (1.1 in. long; spread of wings 3.1 in.), a small species, but the commonest and easiest to adapt to a state of semi-domestication.

1062 - The Alfalfa Looper (*Autographa californica*), Injurious to Various Cultivated Plants in Canada. — GIBSON, A., in *The Agricultural Gazette of Canada*, Vol. V, No. 2, pp. 132-136 + 2 Figs. Ottawa, February, 1918.

*Autographa californica* (the alfalfa looper) is widely distributed in western North America. In Canada it occurs in the provinces of British Columbia, Yukon, Alberta and Manitoba. Although there are no actual records of its presence in Saskatchewan, it undoubtedly occurs, also, in that province. In the United States it occurs in the states of California, Nevada, Colorado, Oregon, Wyoming, Washington, Idaho, Utah and Montana. It has also been collected in Alaska and it appears to be present in New York state. It has been known in the United States as a pest of economic importance since 1895. In Canada, however, it only became sufficiently numerous to cause serious injury to crops in 1914. During that year, the damage caused was confined to the province of British Columbia. A large number of crops — alfalfa, lettuce, clover, beans, apple trees (leaves and fruits), clover, turnips, cabbage, garden peas, potatoes, rhododendrons, laurel, rose, holly, etc. — were attacked.

In the United States the insect has been found feeding on malva, barley, elder, dock, sweet clover, wild lettuce, flax, sugar-beet, maize, carrots, cucumbers, muskmelons, watermelons, squash, currants, gooseberries, raspberries, lamb's-quarters and sunflower.

In 1903, at Ottawa, the author reared an adult moth found feeding on lupine at Mt. Arrowsmith, Vancouver Island, B. C.

In 1914, natural enemies of the alfalfa looper were present in British Columbia to a marked extent. These natural checks were very widespread and efficient. From material received at Ottawa from various localities the following natural enemies were reared: — *Plagia americana* Van der

Wulp, a tachinid fly already known as a parasite of *A. californica*; *Exorista fulvipes* O. S., a new tachinid fly parasite of the moth; *Microplitis alaskensis* Ashm., a hymenopteron known as a parasite of the moth in the United States; the tachinid fly *Phorocera saundersii*; and the hymenoptera *Sargaritis websteri* Vier., *Rhogas autographae* Vier., *Microplitis* sp., *Amelotenus* sp., *Apanteles hyslopi* Vier.

In addition to these natural enemies, birds were observed to feed readily upon the larvae, which, in some localities, were also attacked by a bacterial disease.

Since 1914, there are no records, thanks to its natural enemies, of the insect occurring in destructive numbers.

Paris green or arsenate of lead will destroy the caterpillars if used strong enough, but when they are present in such enormous numbers, spraying with an arsenical mixture is a rather hopeless task. A mechanical means of protection would probably be advantageous, such as digging trenches across the line of march of the caterpillars.

The insect and its life-history are fully described.

1963 - **The West Indian Mole Cricket (*Scapteriscus vicinus*), Injurious to Crops in Porto Rico.** — VAN ZWALUWENBURG, R. H., in the *Porto Rico Agricultural Experiment Station, Mayaguez, P. R., Bulletin*, No. 23, pp. 3-28 + 3 Plates + Bibliography, Washington, 1918.

The most serious insect pest of general agriculture in Porto Rico is the West Indian mole cricket (*Scapteriscus vicinus* Scudder) known locally as the "changa".

In economic literature this insect has always been treated under the specific name of *didactylus* (1) a name now given to a closely related species. *S. vicinus* is a native of South America and the West-Indies, but it does most damage in Porto Rico.

The changa feeds primarily on vegetables, animal food seeming to form only a small part of its diet. Almost any young plant growth is attacked. The insect remains underground and feeds from below, commonly selecting the crown of the plant as the point of attack. *S. vicinus* attacks tobacco, tomato, egg-plant, potato, pepper, sugar cane, grama grass (*Paspalum* sp.), yerba dulce (*Eleusine indica*), Bermuda grass (*Cynodon dactylon*), rice, cabbage, collard, rape, turnip, cantaloup, sweet potato, lettuce, *Colus* spp. and *Livingstonea* spp. The insect also causes much damage by trimming roots that lie along its path.

The author describes the adult and deals with its life history. The life cycle covers about one year. About three weeks are required for the egg state; about nine months for development from hatching to the adult stage; and over two months for the pre-oviposition period.

Although the changa has many natural enemies particularly among the native birds, it is not held in check by them. With the exception of a nematode, no parasitic enemies of the insect are known to occur in Porto Rico.

(1) See R., January 1916, No. 129 (Ed.)

During the autumn months the changa flies in large numbers on damp, overcast evenings. The greater proportion of changas attracted to lighted areas are females. Flooding is of value when water is easily available.

Napthaline and sulphur are the only repellants found to be of any value, and even they are only partially effective.

Sugar cane is protected from the changa by planting it in a perpendicular or slanting position. Hilling up plants greatly reduces changa injury in gardens.

The use of poison baits, together with clean cultivation of the area to be planted, is recommended. A dry mixture of 3 % Paris green with cheap flour is particularly acceptable to the changa.

1064 - *Trioxa alacris*, a Hemipteron Injurious to Laurel in New Jersey, U. S. A.

— WEISS, H. B. and DICKERSON, E. T., in *Psyche*, Vol. XXV, N. 3, pp. 59-63. Boston, June, 1918.

*Trioxa alacris* Flor (syn. *T. lauri* Targ.), which was introduced into New Jersey from Belgium and which is well known and destructive in Europe, had already been recorded by WEISS in 1917 as occurring in New Jersey.

This Psyllid occurs in New Jersey on bay trees which are kept either under glass all the year or out of doors during the summer. Its presence on the bay (*Laurus nobilis*) can be readily detected by the curled, discoloured, swollen, blistered leaves, usually at the tips of the branches, containing what appear to be whitish masses. Observations on the biology of the parasite were made on trees kept outside during the summer months. The author describes the eggs and then the five stages of the nymph, using alcoholic material. The description of the adult is quoted from CRAWFORD.

While contact insecticides are useful, it is impossible to reach the nymphs in the curled leaves. In New Jersey almost complete killing was secured in one case by fumigating with tobacco smoke as for aphids while the trees were in storage and heavily infested by over-wintering adults. Hydrocyanic acid gas has been used with success.

It is the practice of some firms to pick off all curled infested leaves, but this is a slow process in a large establishment.

1065 - *Papilio thoantiades*, a Macrolepidopteron Injurious to Citrus and the Hymenopteron *Pteromalus caridei*, its Natural Enemy, in the Argentine. —

CARIDE MASSINI, P. and BRÈTHES, J., in the *Anales de la Sociedad Rural Argentina*, Vent. LIII, Vol. LII, No. 2, pp. 73-76 + 2 Coloured Plates. Buenos Ayres, 1918.

In Florida the macrolepidopteron *Papilio thoantiades* Burm. ("isoca de los naranjos") is one of the most dangerous pests of citrus plants (orange, lemon, etc.) whose leaves the pest attacks when in the larval state. Fortunately, the chalcidid *Pteromalus caridei* Brèthes, first described in 1913, attacks the pest, laying its eggs in the chrysalis of the lepidopteron. The chalcid also sometimes attacks the macrolepidopteron, which is its only host, in the larval stage.

From each chrysalis of *Papilio* emerge 80 to 100 individuals of *Pteromalus*. In one case 98 % of the chrysalids were attacked.

The hymenopteron can be easily transported and used in the control of *P. thoantiades*; in consequence the chalcid should be bred and protected in citrus-growing regions.

A detailed description of *P. thoantiades* and *P. caridei* is given.

1066 - **A Tortricid Moth Injurious to the Chestnut Tree, in Italy.**— DEL GUERCIO, G., in *L'Agricoltura Coloniale*, Year XII, First Half Year, No. 1, pp. 21-30 + 3 Figs., Florence, 1918.

In the chestnut woods on the Apennines between Emilia and Tuscany, after August has begun, one may see the soil covered to varying degrees, according to the year and the position, with very young chestnuts, still green or partly yellowed. On these chestnuts, hidden by a mass of excreta, is a round hole which is the opening of a tunnel leading into the cavity occupied by the growing achenes (chestnuts).

Inside these husks or in the chestnuts themselves, there are nearly always one or two larvae of different ages, which, according to the author, are the larval stage of a tortricid moth, probably *Carpocapsa splendana*.

According to the inhabitants of the region, the nuts begin to fall in September without, however, affecting the injurious action of the larvae. The presence of the larvae causes the nuts to open prematurely in the second half of September or even at the fall of the first chestnuts.

In October and the beginning of November, the chestnuts are more and more attacked by the larvae and when the drying of the chestnuts by fire is begun in the first half of November (in the high Modenese and Bolognese Apennine), a great number of larvae leave the chestnuts after 24-36 hour's exposure to the heat.

Once the chestnuts are dried and freed from the pericarp, the worm-eaten nuts should be separated from the sound ones before grinding them to obtain the flour used for making "pattona" or "castagnaccio". These foods have often, however, a bitter, unpleasant taste. This is due to the fact that the farmer or proprietor does not separate the sound from the worm-eaten chestnuts in order to have a greater quantity of flour to sell. As a result of this the excreta and larval skins impart the bad qualities of the flour from diseased chestnuts to that from sound chestnuts. Such flour, unfit for human consumption, might be given to live stock, but sparingly, as it might cause various disorders if given in quantity. Moreover, chestnuts eaten by the larvae are not relished by live stock.

To restrain the ravages, the nuts that fall to the ground in August should either be collected and burnt, or buried deeply; they may also be thrown in the pits full of stagnant water which, in the Apennine districts, serve as a manure heap. The first chestnuts to fall must on no account be left lying on the ground and those that fall normally should be collected as soon as possible. When the chestnuts are dried, precautions should be taken that the larve do not escape and seek shelter when, under the action of heat, they leave the chestnuts.

1067 - *Stictolobus trilineatus* n. sp., a Hemipteron (Homoptera) living on Cypress, in Louisiana, U. S. A. — FUNKHOUSER, W. D., in *Entomological News*, Vol. XXIX, No. 5, pp. 185-187 + 1 Plate. Philadelphia, 1918.

The author gives the description of the Membracid *Stictolobus trilineatus* n. sp., found in comparative abundance on cypress at Bogaloussa on June 15, 1917 and on the next day at Colyell, also on cypress.

This insect is the first membracid found on cypress and the second representative of the genus *Stictolobus* founded by METCALF in 1916 to accomodate *Membracis subulata* Say (= *Stict. subulatus* Say).

[1067]



INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

FIRST PART.  
ORIGINAL ARTICLES

**Mechanical Ploughing.**

**Methods for Ploughing in Ridges.**

by  
A. TARCHETTI

*Engineer in Charge of the Mechanical Department of the "R. Stazione Sperimentale  
di Riscoltura" of Vercelli, Italy.*

PLOUGHING IN RIDGES.

This is the most usual method of ploughing in Italian soils, especially for irrigated crops, and it is also that most suited to the great majority of motor- or tractor-ploughs imported from the United States, that is, ploughs turning the soil to one side only (with a single mould-board, right- or left-handed).

This system may be used with balance, turn-wrest and double-brabant ploughs when the open furrows separating the ridges are narrow and shallow. In this case, provided care is taken that the plough wheels do not fall into the open furrow, the ordinary method of ploughing without ridges (1) may be carried out, neglecting the open furrows (especially if a gang plough or, better still, cable traction is used), which will only be partially filled up, thus leaving a depression which will serve as a guide when the open furrow is reopened or put right with an ordinary plough.

(1) See Fig. 1, of the second article, *Methods of ploughing without ridges*, in *R.*, Sept., 1918, p. 1018.